EPA/ROD/R03-01/565
2001

EPA Superfund
Record of Decision:

NAVAL WEAPONS STATION - YORKTOWN
EPA ID: VA8170024170
OU 08
YORKTOWN, VA
10/03/2000

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 Site Name and Location

Site 11, Abandoned Explosives Burning Pits; Operable Unit (OU) X
Site 17, Holm Road Landfill; OU XI
Naval Weapons Station (WPNSTA) Yorktown, Yorktown, Virginia

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) documents the selected remedial action to reduce the risks posed by contaminated media at Sites 11 and 17 located at WPNSTA Yorktown, Yorktown, Virginia. Sites 11 and 17 have been divided into two OUs for remediation:

OU X - Soil at Site 11

- Soil is contaminated with copper and mercury. Site 11 was used from 1930 to 1950 for burning residual nitramines/nitroaromatics including 2,4,6-trinitrotoluene (TNT). The site was closed by filling the burning pits with soil. Soil in the center of Site 11 contains residual metals that may be associated with past practices.

OU XI - Soil at Site 17

- Soil is contaminated with carcinogenic polynuclear aromatic hydrocarbons (cPAHs). Approximately 60 tons of waste, which may have included acid batteries from underwater weapons and hydraulic fluids, were disposed at the site.

The selected remedial action was chosen in accordance with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, with the

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The information supporting the decisions on the selected remedy is contained in the administrative record. Section 2.2.2 lists major documents contained in the administrative record. The Commonwealth of Virginia concurs with the remedy selected in this ROD.

1.3 Assessment of the Sites

The response action selected in the Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment and/or from actual or threatened releases of pollutants or contaminants which may present an imminent and substantial endangerment to public health or welfare.

1.4 Description of the Selected Remedies

The cleanup of OU X and OU XI is part of a comprehensive environmental remediation currently being performed at WPNSTA Yorktown under the Department of Defense (DoD) Installation Restoration (IR) Program.

The removal of soil from Sites 11 and 17 addresses the risk to human health and the environment at OUs X and XI by eliminating source materials (copper, mercury, and PAHs) and eliminating the potential release of these contaminants to other environmental media (unaffected surface soil, subsurface soil, groundwater, surface water, and sediment). Major components of the selected remedies for OUs X and XI include:

OUX - Site 11 - Abandoned Explosives Burning Pits

- Excavating soil in the center of Site 11 containing copper and mercury, exceeding concentrations of 100 milligrams per kilogram (mg/Kg) and 0.3 mg/Kg, respectively. Excavating soil with copper concentrations exceeding 100 mg/Kg and mercury exceeding 0.3 mg/Kg will create the least short-term effects on the local ecology. The depth of the excavation will be approximately two feet, resulting in the removal of approximately 45 cubic yards of soil. Confirmatory soil samples will be collected from the excavated area to ensure that soil posing unacceptable risks has been remediated.

- Disposing of the copper/mercury-contaminated soil at an approved off-site disposal facility.

- Backfilling the excavation area with clean soil fill from the WPNSTA borrow pit.

- Restoring topsoil over the excavation area and then revegetating the area with native grasses.

- Because no unacceptable human health risks were identified for Site 11 and actions shall be taken to reduce the potential for adverse ecological effects, no land use controls are necessary for the site.

OU XI - Site 17 - Holm Road Landfill

- Excavating soil in the area identified as the area of concern (AOC) at Site 17. Soil concentrations in this area exceed the total carcinogenic PAH (cPAH) concentration of 10 mg/Kg. The excavation will be approximately two feet in depth, resulting in the removal of approximately 1,300 cubic yards of soil. Confirmatory soil samples will be collected from the area of excavation to ensure that soil posing unacceptable risks has been remediated.

- Disposing of the cPAH-contaminated soil at an approved off site disposal facility.

- Backfilling the excavation area with clean soil fill from the WPNSTA borrow pit.

- Restoring topsoil over the excavation area, and then revegetating the area with native grasses.

- Land use controls will prohibit future residential property (Site 17) use because soil will be remediated to meet commercial/industrial levels, the reasonably anticipated future land use scenario. Contaminant concentrations exceeding residential remediation levels will, however, remain in soil at Site 17.

1.5 Statutory Determination

The selected remedy is protective of human health and the environment, complies with Federal and Commonwealth of Virginia requirements that are legally applicable or relevant and appropriate requirements (ARARs) to the remedial action, and is cost-effective. The remedy uses permanent solutions and considers alternative treatment technologies to the maximum extent practicable. This remedy does not meet the statutory preference for treatment as a principal element because the hazardous substances in the soil at these sites occur at relatively low concentrations and pose a relatively low level, long-term threat to human health and the environment. In such cases, the Navy expects to use engineering controls (such as placing the soil in an approved of site disposal facility) rather than treatment to reduce the threats. In addition, treatment of the low concentrations of hazardous substances in the soil at these sites is not practicable in a cost-effective manner. Therefore, the selected remedy, which includes excavation and off site disposal of contaminated soil, represents a better balance of tradeoffs under the evaluation criteria than alternatives using treatment.

Because the remedy will result in hazardous substances, pollutants, or contaminants remaining on-site at OU XI above levels that allow unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protection of human health and the environment.

1.6 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations.

- Baseline risk represented by the chemicals of concern.

- Cleanup levels established for chemicals of concern and the basis for these levels.

- How non-principle threat waste source materials are addressed.

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD.

- Potential land use that will be available at the site as a result of the selected remedy.

- Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.

- Key factors that led to the selection of the remedy (i.e., how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

______________________________ 9/27/00

Steven W. Johnson, CAPT, CEC, USN Date

Regional Engineer

By direction of the Commander,

Navy Region, Mid-Atlantic

______________________________ 10/2/00

Abraham Ferdas, Director Date

Hazardous Site Cleanup Division

United States Environmental Protection Agency, Region III

2.0 DECISION SUMMARY

2.1 Site Name, Location, And Description

WPNSTA Yorktown is a 10,624 acre installation located on the Virginia Peninsula in York and James City Counties and the City of Newport News (Figure 2-1). The Station is bounded on the northwest by the Naval Weapons Station Yorktown-Cheatham Annex Site, the Virginia Emergency Fuel Farm, and the future community development of Whittaker's Mill; on the northeast by the York River and the Colonial National Historic Parkway; on the southwest by Route 143 and Interstate 64; and on the southeast by Route 238 and the community of Lackey.

2.1.1 Site 11 - Abandoned Explosives Burning Pits

Site 11 (Figure 2-2) consists of two abandoned burning pits of unknown depth covering an area of approximately 0.5 acres. These pits were backfilled in the late 1950s or early 1960s. Railroad tracks run along the western and northern areas of the site. The topography of Site 11 is relatively flat with the elevation at a consistent 40 feet above mean sea level (msl). The site is currently vegetated.

2.1.2 Site 17 - Holm Road Landfill

Site 17 (Figure 2-2) is a two-acre former disposal area located to the north of Site 11. Railroad tracks run through the western portion of the site and lead to Building 1834. Other railroad tracks run adjacent to the southern and eastern portions of the site. The topography at Site 17 is also relatively flat with elevations ranging between 38 and 42 feet above msl. Currently, the site is overgrown with mature trees and no evidence of surficial waste is apparent.

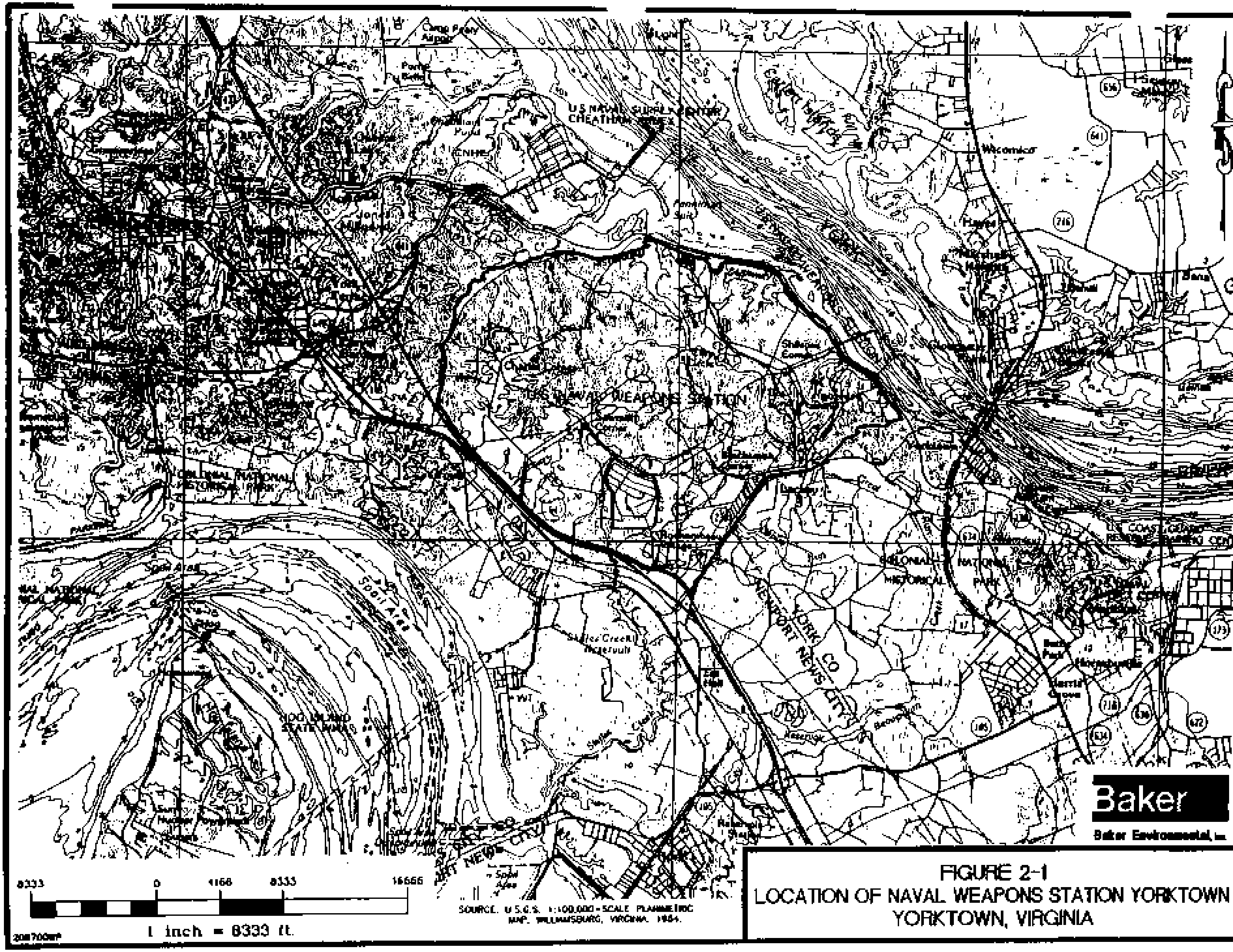


FIGURE 2-1
LOCATION OF NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

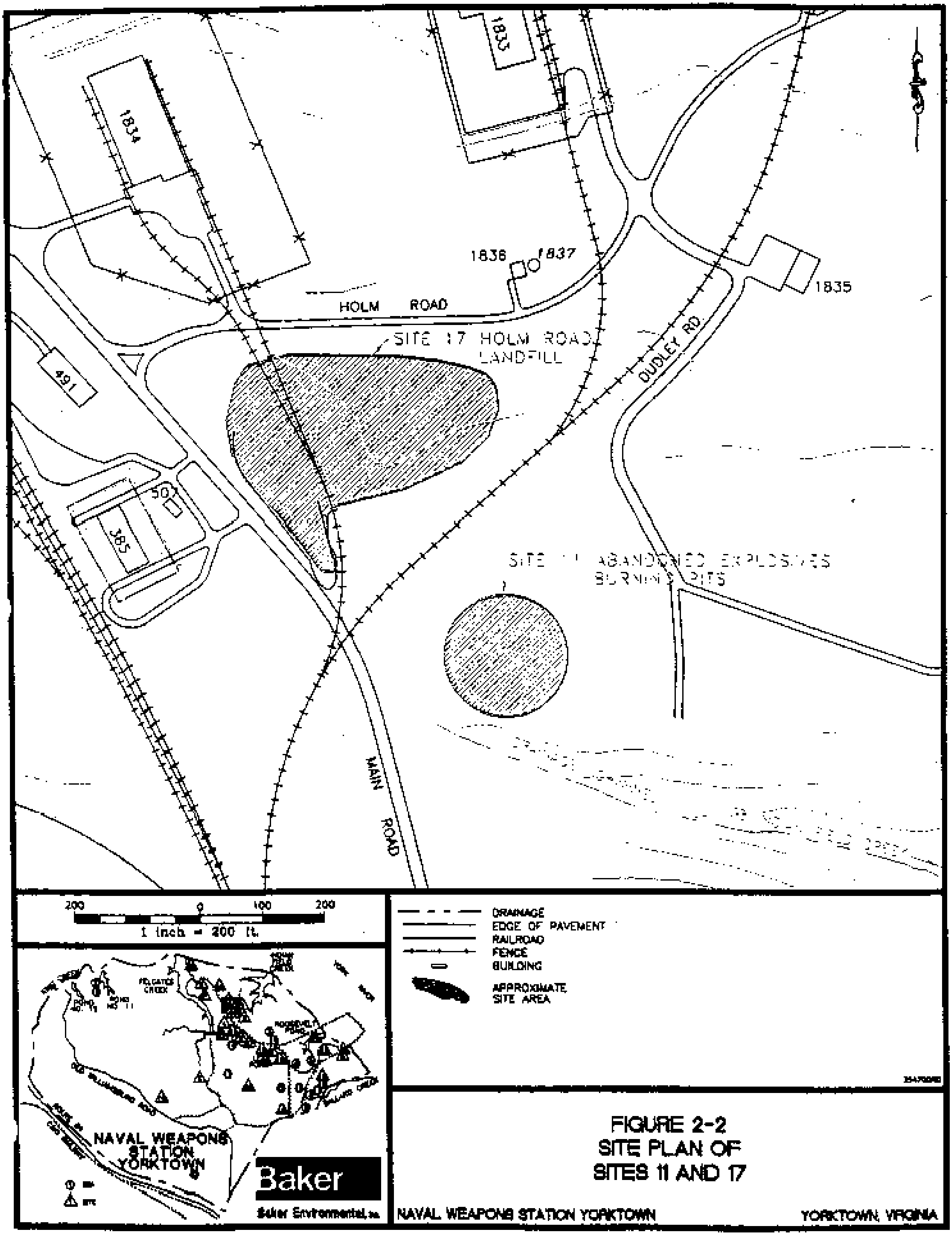


FIGURE 2-2
SITE PLAN OF
SITES 11 AND 17

2.2 Site History and Enforcement Activities

2.2.1 Site History

Originally named the U.S. Navy Mine Depot, WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. For 20 years after World War I, the depot received, reclaimed, stored, and issued mines, depth charges, and related materials. During World War II, the facility was expanded to include three additional 2,4,6-trinitrotoluene (TNT) loading plants and new torpedo overhaul facilities. A research and development laboratory for experimentation with high explosives was established in 1944. In 1947, a quality evaluation laboratory was developed to monitor special tasks assigned to the facility, which included the design and development of depth charges and advanced underwater weapons. On August 7, 1959, the depot was redesignated the U.S. Naval Weapons Station. The primary mission of WPNSTA Yorktown is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy.

Site 11 was reportedly used from 1930 to 1950 for burning residual nitramines/nitroaromatics and nitramine/nitroaromatic-contaminated waste. Nitramines/nitroaromatics are chemicals like TNT which are commonly referred to as explosives. During the 20 years that the pits were used, approximately 200 pounds of residual explosives and explosives-contaminated waste may have been deposited and burned. Ash from burning operations may have been buried in the pits. The site was reportedly closed by filling in the pits with soil.

Site 17 was operated for about 10 years beginning in the, early 1950s. Approximately 60 tons of waste were reportedly disposed at the site. Wastes may have included acid batteries from underwater weapons, hydraulic fluids from the demilling of torpedoes, other types of hydraulic fluids, drums from the Public Works Department or ordnance production shops, and scrap metal. It was also reported that wastes were buried using bulldozers, and that the site was covered with earth when disposal operations ceased. There are no visible signs of past disposal activities noticeable at Site 17.

2.2.2 Enforcement Activities

On October 15, 1992, WPNSTA Yorktown was included on the National Priorities List (NPL). A Federal Facility Agreement (FFA) between the United States Environmental Protection Agency (USEPA) Region III, the Commonwealth of Virginia, and the Department of the Navy (DoN) was finalized in August of 1994 for WPNSTA Yorktown. The FFA is intended to cover the investigation, development, selection, and implementation of Response Actions for all releases or threatened releases of hazardous substances, contaminants, hazardous wastes, hazardous constituents, or pollutants at or from WPNSTA Yorktown.

No documented enforcement activities have been conducted to date at either Site 11 or Site 17 under the FFA. The following documents provide details of the site investigations and assessments for Sites 11 and 17. The documents are part of the administrative record.

- C.C. Johnson & Associates, Inc. and CH2M Hill. Initial Assessment Study of Naval Weapons Station, Yorktown. July 1984.

- Dames & Moore. Confirmation Study Step IA (Verification). Round One, Naval Weapons Station, Yorktown, Virginia. June 1986.

- Dames & Moore. Confirmation Study Step IA (Verification) Round Two, Naval Weapons Station, Yorktown, Virginia. June 1988.

- Dames & Moore. Draft Remedial Investigation Interim Report, Naval Weapons Station, Yorktown, Virginia. February 1989.

- Baker Environmental, Inc. and Roy F. Weston, Inc. Final Round One Remedial Investigation Report for Sites 1-9, 11, 12, 16-19 and 21, Naval Weapons Station, Yorktown, Virginia. July 1993.

- Baker Environmental, Inc. Final Round Two Remedial Investigation Report for Sites 11 and 17, Naval Weapons Station Yorktown, Yorktown, Virginia. August 1998.

- Baker Environmental, Inc. Final Feasibility Study Report, Sites 11 and 17, Naval Weapons Station Yorktown, Yorktown, Virginia. May 1999.

2.2.3 History of Previous Investigations

The purpose of the Initial Assessment Study (IAS) (C.C. Johnson & Associates, Inc. and CH2M Hill, July 1984) was to identify and assess sites at WPNSTA Yorktown posing a potential threat to human health or the environment because of contamination from past operations. Nineteen potentially contaminated sites were identified based on information from historical records, aerial photographs, field inspections, and personnel interviews. Each site was evaluated for the type of contamination, migration pathways, and pollutant receptors. The IAS concluded that 15 of the 19 sites, including Sites 11 and 17, were of sufficient threat to human health or the environment to warrant Confirmation Studies.

A Confirmation Study was conducted for the 15 sites identified in the IAS. Two rounds of data were obtained during the Confirmation Study. The first round of data was collected in the winter of 1986. This effort was documented in the "Confirmation Study Step IA (Verification), Round One," (Dames & Moore, 1986). The second round of sampling was conducted during November and December 1987. The results of the analyses and comparisons with appropriate regulatory standards were presented in the "Confirmation Study Step IA (Verification), Round Two," (Dames & Moore, 1988).

The 15 sites, including Sites 11 and 17, were recommended in the Confirmation Study for further study and were evaluated as part of the Round One Remedial Investigation (RI), conducted in 1993. Soil, surface water, sediment and groundwater were collected and analyzed for Target Compound List (TCL) organic compounds, and Target Analyte List (TAL) inorganic compounds. Data generated during the Round One RI were compared to standards or available criteria and the sites were further recommended for additional investigation, if necessary.

Round One Confirmation Study activities at Sites 11 and 17 included the installation and sampling of two groundwater monitoring wells per site and the collection and analysis of two surface water/sediment samples. The analyses performed on the samples included priority pollutants (including volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], pesticides, and polychlorinated biphenyls [PCBs]), explosives, inorganics, and various other parameters. Based on the results of the Round One Confirmation Study, it was recommended that all previous analyses from the Round One sampling stations be confirmed by repeating the sampling effort in a Round Two Confirmation Study for both Sites 11 and 17.

Round Two Confirmation Study activities at Sites 11 and 17 included sampling of the four existing groundwater monitoring wells and the collection and analysis of four surface water/sediment samples from Indian Field Creek and its tributaries. The analyses included priority pollutants (including VOCs, SVOCs, pesticides, and PCBs), explosives, inorganics, and various other parameters. No recommendations for Sites 11 and 17 with respect to further investigations were presented in the Round Two Confirmation Study.

Round One RI activities conducted in 1993 included soil, surface water, sediment and groundwater sampling. Samples were analyzed for TCL organics, TAL inorganics and nitramine/nitroaromatic compounds (explosives). Data generated during the Round One RI were compared with standards (Federal and State water, drinking water, and water quality) or available criteria (NoAA sediment screening values) for protecting human health and the environment. Sites 11 and 17 were further recommended for additional investigation.

At Site 11, three subsurface soil samples, four groundwater samples, two surface water samples, and four sediment samples were collected during the Round One RI. The analytical results indicated that only inorganic contaminants were detected in the soil samples. Organic compounds were, however, detected in groundwater samples collected during the Round One RI. They include the semivolatile compound diethylphthalate, and explosive compounds HMX, and RDX. Surface water samples were collected from standing water in the drainage ditch, south of Site 11. The organic compounds acetone, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, and RDX were detected. These contaminants were not detected in any of the sediment samples.

At Site 17, six surface soil samples, three subsurface soil samples, and five groundwater samples were collected during the Round One RI. The organic compounds detected in the surface soil samples included VOCs and SVOCs. The detected SVOCs were primarily PAHs. The highest PAH concentrations were detected in sample 17S02-001 which was collected in the northern portion of the site. A common laboratory contaminant, methylene chloride, was the only VOC detected in the subsurface soil samples. SVOCs, pesticides and PCBs were not detected in soil samples obtained at depth (greater than 2-feet below ground surface). The majority of the inorganic analytes were detected at concentrations similar to the background sample concentrations. Groundwater samples obtained from Site 17 appeared to be unaffected by reported past disposal activities. The only organic compound detected in groundwater samples was acetone (a common laboratory contaminant).

As a result of the Round One RI findings, Sites 11 and 17 were targeted for more comprehensive investigation and a baseline risk assessment to better evaluate the significance of site-related contamination.

Round Two RI activities were conducted at Sites 11 and 17 to assess the nature and extent of contamination at the sites and to address data gaps observed after the Round One RI. The Round Two RI field investigation for Sites 11 and 17 commenced on October 28, 1996 and continued until November 20, 1996. The field effort was conducted in conjunction with a Round Two RI field program for three other WPNSTA Yorktown IR sites. The nature and extent of contamination identified from the Round Two RI results will be discussed in Section 2.5 of this ROD. A baseline human health risk assessment (RA) and ecological RA were conducted as part of the Round Two RI and results of the human health and ecological RAs are presented in Section 2.6. The results of the Round Two RI, including the human health and ecological RAs indicated that a Feasibility Study (FS) was necessary for Sites 11 and 17 to address unacceptable human health risks and potential adverse ecological effects.

An FS was conducted in May, 1999 for Sites 11 and 17 based on the results of the Round Two RI. A set of potential remedial action alternatives (RAAs) was developed and evaluated in the FS. Sections 2.7 and 2.8 of this ROD present the RAAs that were developed in the FS and provide a summary of the comparative analysis performed for the RAAs.

2.3 Highlights of Community Participation

The Proposed Remedial Action Plan (PRAP) for Sites 11 and 17 was released to the public in May 1999 at the four information repositories listed below:

- York County Public Library
  8500 George Washington Highway
  Yorktown, VA 23692
  (757) 890-3377

- Newport News City Public Library - Grissom Branch
  366 Deshazor Drive
  Newport News, VA 23506
  (757) 886-7896

- Gloucester Public Library
  P.O. Box 367, Main Street
  Gloucester, VA 23601
  (804) 693-2998

- Naval Weapons Station Yorktown
  Environmental Directorate
  Building 31-B, P.O. Drawer 160
  Yorktown, VA 23691-0160
  (757) 887-4775 (ext. 29) (Contact: Mr. Jeffrey Harlow)

The notice of availability of this document was published in the *Daily Press* on May 16, 1999. A public comment period was held from May 16, 1999 to June 30, 1999. A public meeting was held on May 20, 1999 at the Charles E. Brown Community Building, Route 238, Lackey, Virginia. This meeting was held to inform interested members of the community about the preferred remedial alternatives under consideration and to seek public comments. At the public meeting, representatives from DoN, USEPA, and VADEQ were available to answer questions about the sites and the remedial alternatives under consideration. A transcript of the public meeting is attached to this document as Appendix A.

2.4 Scope and Role of the Remedies

WPNSTA is a large (10,624 acre) and complex superfund site. To make work manageable, the Navy has divided WPNSTA into 19 sites. Some sites have been further subdivided into operable units (OUs). There are currently fifteen OUs at WPNSTA. The Navy and EPA have selected remedies for nine sites and the remedial actions (RAs) for OUs I through IX have been completed. OUs X through XV are either in the construction phase (OUs XII, XIII, XIV, and XV) or are in the pre-remedial design phase (OUs X and XI).

These studies at Sites 11 and 17 are part of comprehensive environmental investigations being conducted under the IR Program at WPNSTA Yorktown. OU X consists of mercury/copper-contaminated soil at Site 11. OU XI consists of PAH-contaminated soil at Site 17. To protect human health and the environment, the mercury/copper and PAH-contaminated soil at Sites 11 and 17, respectively, will be excavated to a depth of approximately two feet. The soil will be transported off-site to an approved disposal facility. All excavated areas will be backfilled with clean soil and revegetated. Because there are no unacceptable human health risks associated with contamination at Site 11, land use controls will not be implemented after soils are removed to protect ecological receptors. Land use controls will be implemented at Site 17 to prohibit residential development activities because contaminants will be left in place above residential remediation levels.

2.5 Summary of Site Characteristics

2.5.1 Site 11 - Characteristics

Surface soil, subsurface soil, groundwater and sediment samples were collected during both Round One and Round Two remedial investigations. Surface water samples were collected during the Round One RI only. It should be noted that groundwater will not be addressed in this ROD, but will be the subject of a comprehensive groundwater ROD, which will be submitted when all groundwater investigations at WPNSTA Yorktown are completed. Groundwater data are presented for informational purposes only in this section.

Explosive compounds including TNT (maximum=0.37 mg/Kg) and amino-dinitrotoluenes (maximum = 0.59 mg/Kg) and low levels of pesticides including 4,4'-DDT (maximum = 47 μg/Kg) were detected in Site 11 surface soil samples. The presence of pesticides in Site 11 soil is the result of past, legal application for pest-control and is not site related. Inorganic contaminants including chromium (maximum = 48.9 mg/Kg), copper (maximum = 220 mg/Kg), lead (maximum = 48.5 mg/Kg), silver (maximum = 28 mg/Kg) and zinc (maximum = 76.7 mg/Kg) were also detected in surface soils at concentrations which exceed maximum detected WPNSTA Yorktown, Station-wide background values. Concentrations of surface soil inorganic contaminants are presented on Figure 2 -3.

Concentrations of organic contaminants in subsurface soil are similar to those detected in surface soil samples. Only selenium, which was detected at two subsurface soil locations (maximum= 0.8 mg/Kg), exceeded Station-wide background subsurface soil concentrations.

Sediment samples obtained from a small drainage ditch just south of Site 11 contained the organic contaminant toluene (3J μg/Kg)[1] and phthalates, which can be introduced by field personnel during the sampling effort (i.e., contact with plastics present in some personal protection equipment) or by the laboratory during sample analysis. Bis(2-ethylhexyl)phthalate and di-n-octyl phthalate were detected at a concentration of 120J μg/Kg and 140J μg/Kg, respectively, in one sample. Cadmium, copper, manganese, selenium, and silver were detected in shallow (0-4 inches) and deeper (4-8 inches) sediment samples above Station-wide freshwater background concentrations. During the Round Two RI sampling event, the ditch was dry and surface water samples could not be obtained.

Groundwater samples were also obtained from shallow and deeper aquifers at the site. The volatile organic compound chloromethane (3J μg/L) was detected in one shallow groundwater sample. The explosive compounds RDX and amino-DNTs were detected in a deeper groundwater sample at concentrations of 1.4 and 6.2 μg/L, respectively. Barium, manganese, and nickel were detected above Station-wide background concentrations in both filtered and unfiltered shallow groundwater samples. Dissolved inorganics were not detected at concentrations exceeding Station-wide background concentrations in deeper groundwater samples indicating that they exist as particles and not as soluble entities in groundwater at this site.

[1] J - Value is estimated because the reported concentration is below the detection limit.

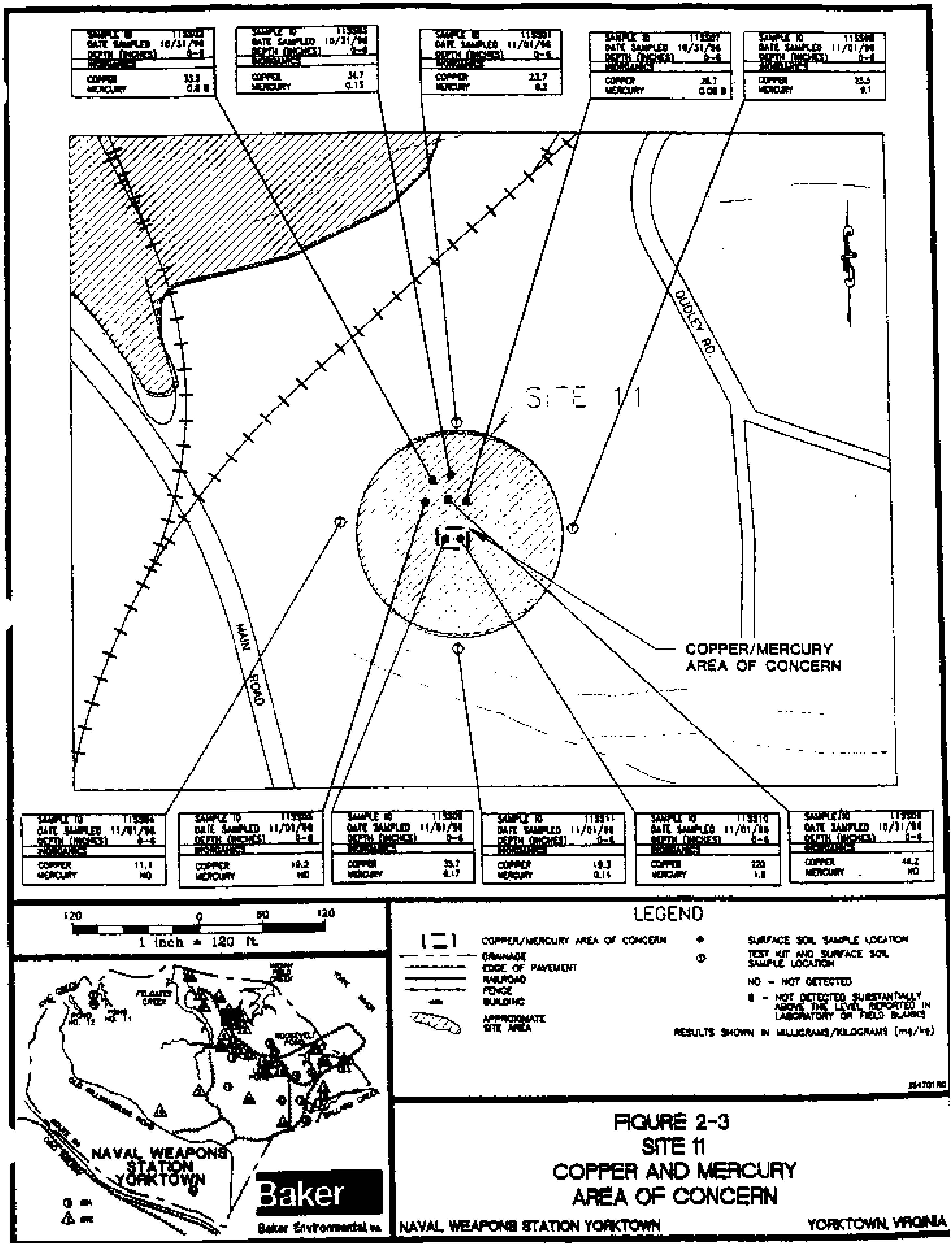

SITE 11
DUDLEY RD.
MAIN ROAD
COPPER/MERCURY AREA OF CONCERN
SAMPLE ID
DATE SAMPLED
DEPTH (INCHES)
COPPER
MERCURY
120 0 60 120
1 inch = 120 ft.
LEGEND
COPPER/MERCURY AREA OF CONCERN
DRAINAGE
EDGE OF PAVEMENT
RAILROAD
FENCE
BUILDING
APPROXIMATE SITE AREA
SURFACE SOIL SAMPLE LOCATION
TEST KIT AND SURFACE SOIL SAMPLE LOCATION
ND - NOT DETECTED
B - NOT DETECTED SUBSTANTIALLY ABOVE THE LEVEL REPORTED IN LABORATORY OR FIELD BLANKS
RESULTS SHOWN IN MILLIGRAMS/KILOGRAMS (mg/kg)
NAVAL WEAPONS STATION YORKTOWN
Baker
Baker Environmental, Inc.
FIGURE 2-3
SITE 11
COPPER AND MERCURY
AREA OF CONCERN
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Figure 2-4 is a conceptual site model that was developed for Site 11. The model presents the sources release mechanisms, pathway for exposure, and receptors.

2.5.2 Site 17 - Characteristics

Surface soil, subsurface soil and groundwater samples were collected from Site 17 during both Round One and Round Two remedial investigations. Analytical results for groundwater samples are presented for informational purposes only in this section because groundwater is not addressed in this ROD. Groundwater will be addressed in a separate ROD when all groundwater investigations at WPNSTA are completed.

Surface soil samples contained polynuclear aromatic hydrocarbons (PAHs) which include carcinogenic PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and chrysene) and noncarcinogenic PAHs (acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthene, phenanthrene, and pyrene). The highest concentrations of PAHs were detected in the central portion of Site 17, where maximum concentrations of benzo(a)pyrene (9.5 mg/Kg), benzo(b)fluoranthene (8.5 mg/Kg), benzo(a)anthracene (6.5 mg/Kg), pyrene (9.5mg/Kg) and other PAHs were observed. Total carcinogenic PAHs (cPAHs) were detected at concentrations as high as 41.7 mg/Kg in this area. Figure 2-5 presents total surface soil cPAH concentrations at Site 17.

Inorganic contaminants were also detected in surface soil samples. Copper (maximum = 26.7 mg/Kg), mercury (0.19 mg/Kg), and selenium (0.99L mg/Kg)[2] exceeded Station-wide background values for surface soil.

Six test pits were randomly located and installed as part of the Round Two RI to determine the presence of buried debris at Site 17. Buried debris was not observed at any test pit location. Lower concentrations of PAHs were detected in subsurface soil samples obtained from these test pits. Benzo(a)pyrene was detected in only one sample and its duplicate at 0.22J mg/Kg and 0.091J mg/Kg, respectively. Selenium and mercury were also detected once in excess of Station-wide background

[2] L - Value is estimated and may be biased low.

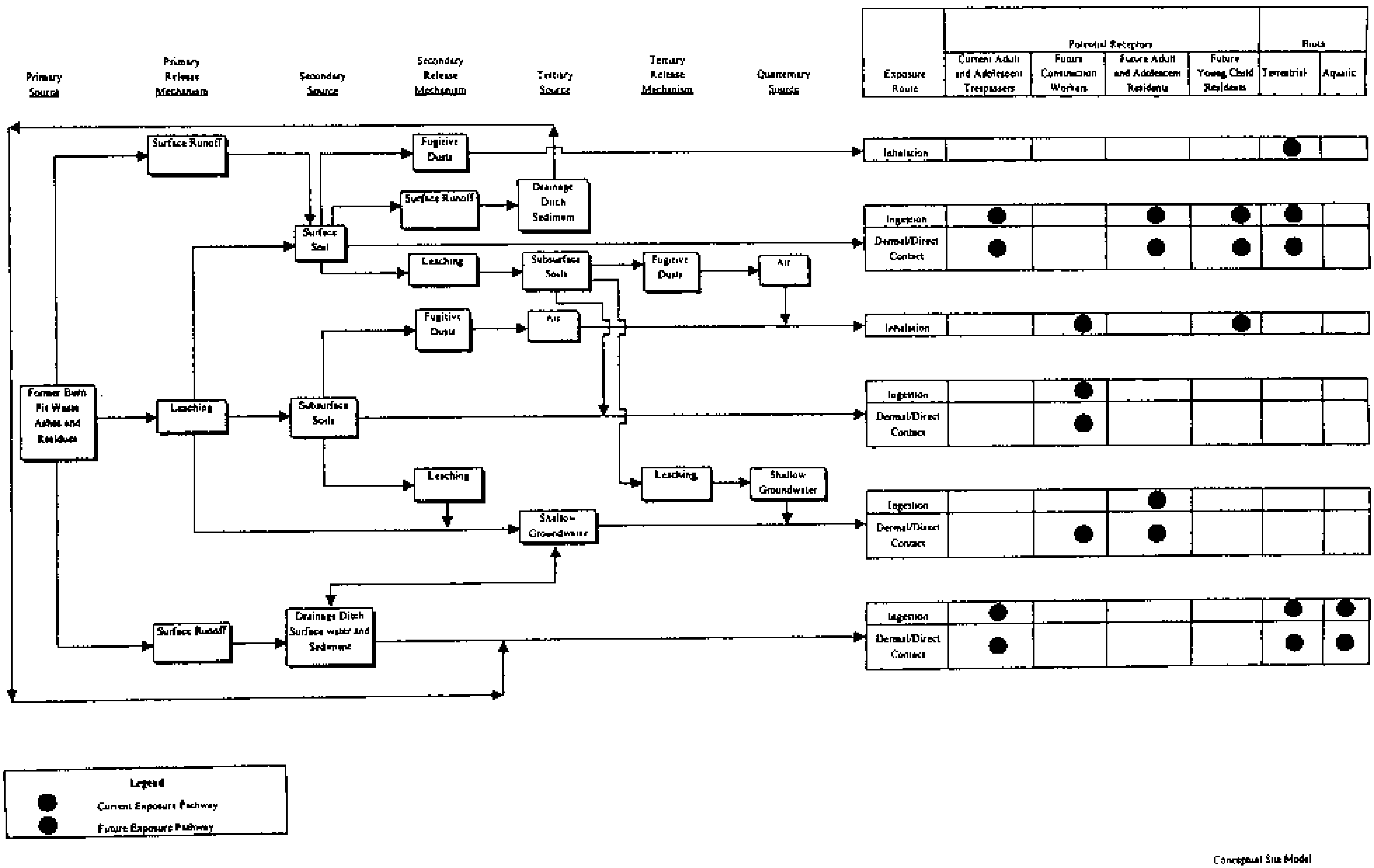
FIGURE 2-4

CONCEPTUAL SITE MODEL

FOR SITE 11

NAVAL WEAPONS STATION YORKTOWN

YORKTOWN, VIRGINIA



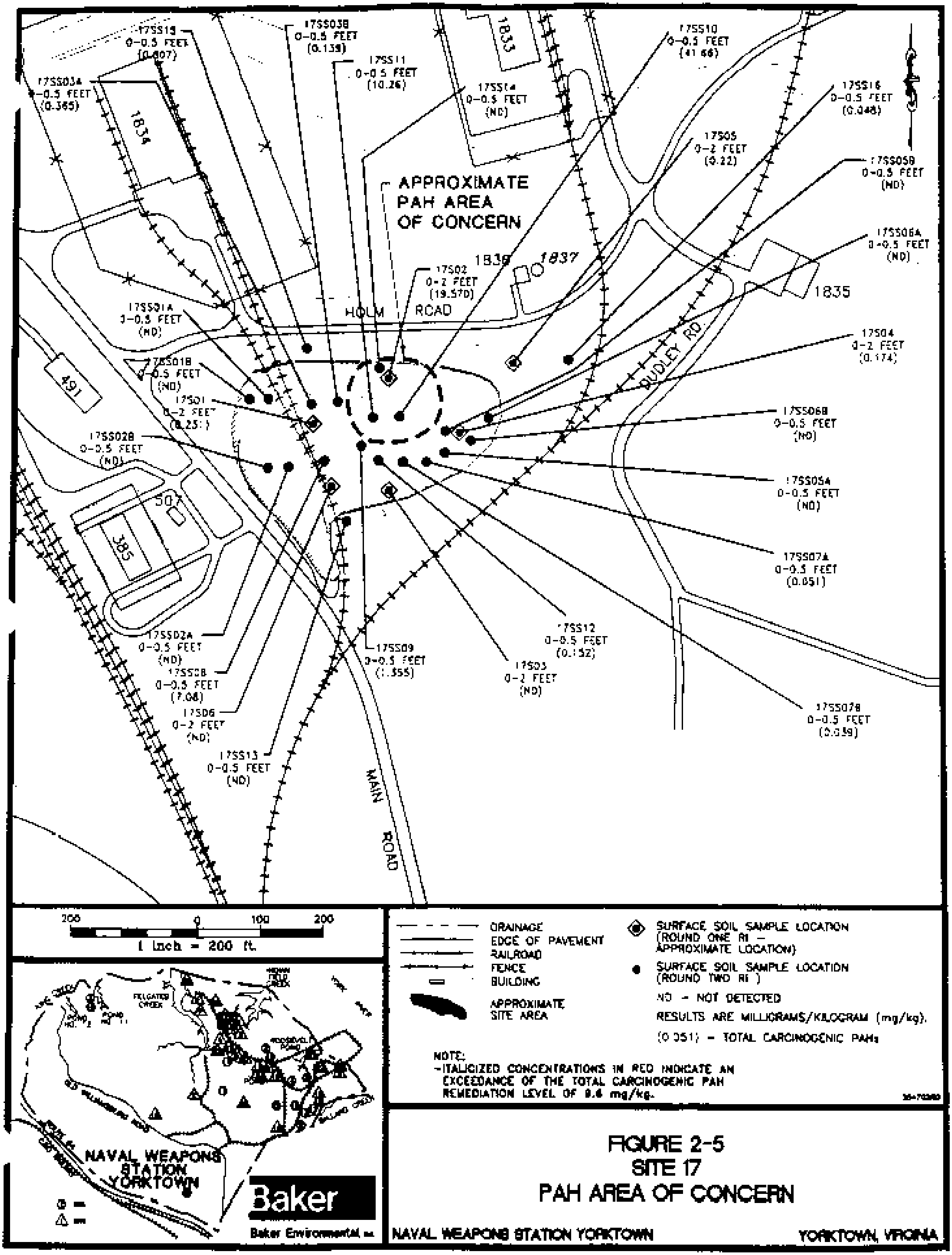


FIGURE 2-5
SITE 17
PAH AREA OF CONCERN

NAVAL WEAPONS STATION YORKTOWN — YORKTOWN, VIRGINIA subsurface soil values. Subsurface soil data indicate that contamination at Site 17 is limited to the upper 0 to 2 feet bgs soil interval and not at depth, contrary to site historical information.

Amino-DNTs (1.3 ug/L) were detected in one of four shallow groundwater samples obtained at Site 17. Arsenic, barium, and nickel were detected in unfiltered groundwater samples at concentrations that exceed Station-wide background concentrations. Barium was also detected in the filtered groundwater sample indicating that it may exist in groundwater as a dissolved or soluble contaminant.

A conceptual site model was developed for site 17 and is presented on Figure 2-6. The model shows the sources, release mechanisms, pathways for exposure, and receptors.

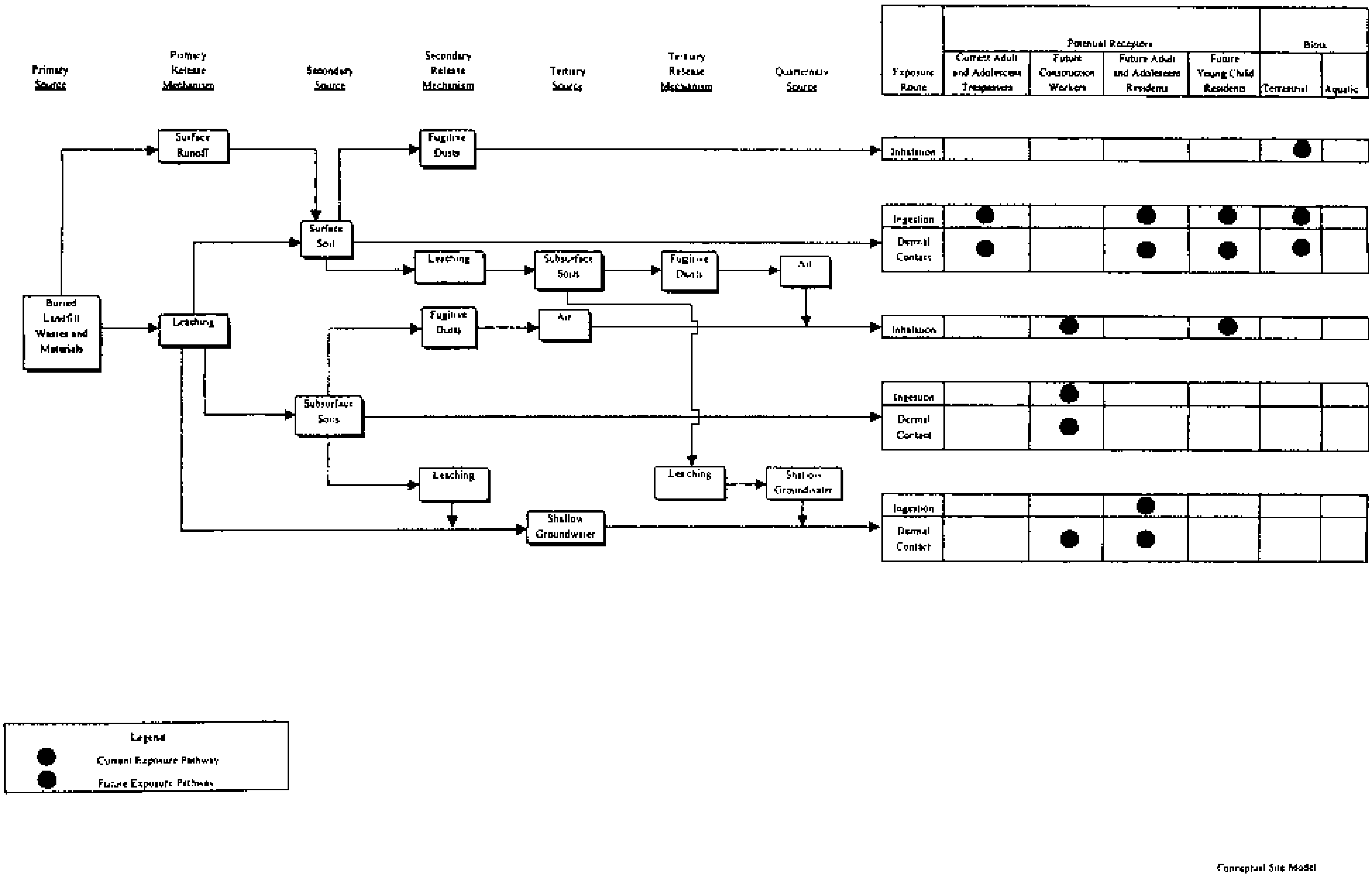
2.6 Current and Potential Future Land and Resource Uses

The mission for WPNSTA Yorktown is to sustain war-fighting capabilities for all branches of the armed services. As a result, activities and land use at WPNSTA Yorktown are largely industrial. This is particularly true of Sites 11 and 17 which are located along the industrialized Main Road corridor. Sites 11 and 17 are encompassed by the restricted area and access is limited. These sites also fall within the explosives safety quantity distance (ESQD) arc. The ESQD arc estimates the area that would be affected in the event of an uncontrolled detonation of stored munitions. Residential development of areas falling within the ESQD arc and the restricted area are, therefore, prohibited by the Navy.

Groundwater at WPNSTA Yorktown is not currently used. Shallow groundwater throughout WPNSTA Yorktown contains iron and manganese concentrations exceeding federal Secondary Maximum Contaminant Levels (SMCLs). Groundwater yields from shallow aquifers are also relatively low and would not be sufficient for potable use. Therefore, the future beneficial use of shallow groundwater at WPNSTA Yorktown would likely be nonpotable use (i.e., watering lawns).

This ROD does not address groundwater at Sites 11 and 17. Groundwater at Sites 11 and 17 will be addressed as a separate OU in a future Station-wide groundwater ROD.

FIGURE 2-6
CONCEPTUAL SITE MODEL
FOR SITE 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA



There are no surface water features at either Site 11 or Site 17, but a small drainage feature exists at Site 11. This drainage way holds water only during storm events. As a result, potential exposure at Site 11 is limited to direct contact with sediments.

2.7 Summary of Site Risks

A baseline RA was conducted as part of the Sites 11 and 17 Round Two RI Report (Baker, 1998). Both human health and ecological risk assessments were conducted. The baseline RA estimates what risks the sites would pose if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk RA for Sites 11 and 17.

Human health risks are described by evaluating noncarcinogenic (systemic) and carcinogenic health effects. Reference dose (RfDs) values have been developed by the USEPA for indicating the potential for adverse health effects from exposure to contaminants of potential concern (COPCs) exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/Kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. RfDs are derived from human epidemiological data or animal studies to which uncertainty factors have been applied to account for the use of animal data to predict effects on humans. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose for a similar exposure period. The ratio of exposure to the reference dose is called a hazard quotient (HQ). HQ values are then summed to produce hazard indices (HIs) for each potential receptor and means of exposure (dermal, ingestion, inhalation). If a hazard index is greater than or equal to 1.0, the contaminants included in the hazard index are reexamined to see whether they affect the same target organ (e.g., liver). If they do not, new hazard indices are computed, summing HQ values only for contaminants that affect a single target organ. Contaminants that affect a single target organ and produce a hazard index greater than or equal to 1.0 are considered to be chemicals of concern (COCs) and remedial action is considered to reduce the risk of adverse, noncarcinogenic health effects in the exposed population.

Carcinogenic human health risks are expressed as a probability known as an incremental lifetime cancer risk (ICR). This risk is the incremental probability that an individual will develop cancer in his or her lifetime following exposure to a contaminant. These risks are usually expressed in scientific notation (e.g., 1×10^{-6}). An incremental lifetime cancer risk of 1×10^{-6}, for example, indicates that an individual who receives an estimated reasonable maximum exposure to contaminants at a site has a 1 in 1,000,000 chance of developing cancer as a result. This is referred to as an “incremental lifetime cancer risk” because it would be in addition to the risks of cancer that individuals face from other causes (for example, smoking). ICR values for all potentially carcinogenic COPCs to which a person may be exposed are added together to produce a total ICR value. The total ICR value is compared with USEPA’s acceptable risk range of 1 x 10^{-4} to 1 x 10^{-6}.

The acceptable risk range is the range of cancer risks considered to be acceptable at most sites under most circumstances. For example, the upper end of USEPA’s acceptable risk range, 1 x 10^{-4}, means that one additional cancer case is estimated to occur in an exposed population of 10,000 as a result of exposure to the site. It can also mean that an individual with an ICR value of 1 x 10^{-4} has an estimated increased probability of 0.01% of contracting cancer following exposure over the course of a lifetime.

ICR values of 10^{-4} or greater are evaluated to identify those contaminants in environmental media responsible for 95% of the unacceptable risk. These chemicals are considered to be COCs and remedial action is considered to reduce the cancer risk.

Because WPNSTA Yorktown was placed on the National Priorities List (NPL), in part, as a result of ecological concerns (proximity to wetlands, etc.), potential ecological receptors are also evaluated at each site. Terrestrial and aquatic receptors are evaluated using a weight-of-evidence approach which consists of two phases: (I) a general comparison to existing toxicity criteria, and (II) conservative contaminant uptake modeling to establish a site-specific body burden in an animal receptor and a comparison to published toxicity data for a similar animal. Both phases of the ecological risk assessment culminate with the calculation of ecological HQs. Ecological HQ values equal to or greater than one indicate the potential for adverse effects on the environment. Chemicals producing HQs equal to or greater than one in both phases of the weight-of-evidence approach are considered ecological COCs pending a comparison to Station-wide background. Remediation of these contaminants must, however, be considered carefully, so that the selected remedy does not create more short-term harm to ecological receptors than is produced by leaving contaminants in place. For example, scientists must decide if more damage will be done by removing soil and altering the existing habitat or by having contaminants remain in the soil.

2.7.1 Human Health Risk Assessment

For Site 11, surface soil, shallow subsurface soil, subsurface soil, groundwater, and sediment were evaluated in the human health RA. For Site 17, surface soil, shallow subsurface soil, subsurface soil, and groundwater were evaluated in the human health RA. Only risks associated with soil collected from Site 17 and soil/sediment from Site 11 will be presented. Groundwater will be addressed as a separate operable unit in a future ROD and will not be addressed by this ROD.

Both current and future potential human exposure scenarios were evaluated. Because of the nature of activities conducted at and around Sites 11 and 17 potential current human exposure is limited. Both sites lie within the Explosive Safety Quantity Distance arc (associated with the storage of munitions) and inside the restricted area of the Station. Residential development is not permitted in these areas. Current and future potential human receptors evaluated in the baseline human health RA for Sites 11 and 17 include:

- Current Adult On-Station Trespassers
- Current Adolescent On-Station Trespassers (7 to 15 years old)
- Future On-Site Resident Adults
- Future Younger Resident Children (1 to 6 years old)
- Future Adolescent Resident Children (7 to 15 years old)
- Future Adult Commercial/Industrial Workers
- Future Adult Construction Workers

Potential receptors were selected based on available information concerning Station activities at Sites 11 and 17 and all foreseeable potential future land-use scenarios including future residential property use.

The current adult and adolescent trespasser scenario is unlikely, but assumes that Station personnel and adolescent family members could trespass during recreational activities. Current adult and adolescent tresspassers were evaluated for potential risks associated with exposure to soil and sediment collected from Site 11. The exposure potential was assumed to occur up to 26 days per year for nine years for the adolescent. Adult exposure could occur up to 26 days per year for 30 years. This estimate is conservative because current property use restrictions prohibit this type of exposure at Sites 11 and 17.

They are located away from significant water bodies present at the Station (i.e., Felgates Creek, Indian Field Creek, Lee Pond and Roosevelt Pond) and are less likely than other sites to be traversed.

Potential On-Station trespassers include WPNSTA personnel and family members that may access the sites for recreational purposes. Potential exposure to the contaminated media for these potential current receptors includes accidental ingestion of and dermal contact with surface soil and sediment. Total risks were estimated by site for the current potential trespassers using both reasonable maximum exposure (RME) and central tendency (CT) estimates of exposure. The RME is the highest exposure that is reasonably expected to occur at a site and in practice is estimated by combining upper bound (90th and 95th percentile) values (USEPA, 1989). CT describes the arithmetic mean risk or median risk (USEPA, 1992).

Future residential development is unlikely at Sites 11 and 17 because they fall within the restricted area of the Station. However, the future on-site adult, adolescent, and young child resident scenarios were evaluated to address all types of potential exposure and provide a conservative estimate of future human risk. Future adult and child residents were evaluated for potential exposure to surface soil, and sediment (at Site 11 only). Potential exposure for these future receptors included ingestion of and dermal contact with surface soil and sediment. Exposure frequency for surface soil and sediment of 350 days per year was used with durations of 15 years for the adult, nine years for the adolescent, and six years for the child resident. For Site 11 sediment, an exposure frequency of 40 days per year with the same durations as for surface soil was assumed.

In addition to residents, future commercial/industrial and future construction workers were evaluated at Sites 11 and 17. Future commercial/industrial workers were evaluated for potential exposure to surface soil, and future construction workers were evaluated for potential exposure to subsurface (2 feet bgs and below) and to shallow subsurface (0-2 feet bgs) soil. An exposure frequency for soil of 250 days per year was used for all future workers. Exposure duration of twenty years and one year were used for commercial/industrial workers and construction workers, respectively.

For each exposure route and potentially exposed population, ICR values and HI values were calculated to quantify potential risks. The following subsections present a summary of risks (i.e., ICR values > $1.0x10^{-4}$ and HI values $\geq$ 1.0) for potential human receptors.

2.7.1.1 <u>Site 11 - Human Health Risks</u>

Tables 2-1 through 2-3 present the soil COPCs evaluated in the human health RA for Site 11. As presented on Table 2-4, total ICR values for the current adult and adolescent on-Station trespassers at Site 11 fell within the USEPA's generally acceptable target risk range of 1.0×10^{-6} to 1.0×10^{-4}. HI values presented for current potential human receptors at Site 11 fell below 1.0, indicating that noncarcinogenic adverse human health risks will not occur subsequent to exposure.

Table 2-5 presents total ICR values for the future adult, child, and adolescent residents. Risks are also presented for potential future industrial/commercial workers and construction workers. ICR values for each potential future receptor group fall within the acceptable risk ranges. However, the HI value for children exceeds 1.0 (HI=1.1). Unacceptable systemic health effects are not expected because the HI value of 1.1 is produced by the presence of arsenic, iron, aluminum, and chromium (Table 2-6), which affect different target organs. Hazard quotients for these contaminants should, therefore, not be summed for remedial action decision making purposes. For example, the target organ for arsenic is the skin (keratosis/hyperpigmentation) and the target organ for manganese is the central nervous system and the lungs (adverse effects). The target organs for iron include the hepatic parenchyma (fibrosis), the heart (cardiac dysfunction and failure), and the endocrine glands (hypogonadism). Available aluminum and chromium toxicity data do not identify specific target organs.

Results of the human health RA indicate that surface soil, subsurface soil, and sediment obtained from Site 11 pose no unacceptable risk to any current or future potential human receptors.

2.7.1.2 <u>Site 17 - Human Health Risks</u>

Because of the PAH contamination detected in several Site 17 soil samples, the site was subdivided so that PAHs would not be diluted by the larger number of soil samples obtained from otherwise unaffected areas of the site. PAH contamination was referred to as the Site 17 Soil Area of Concern

TABLE 2-1

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSIS
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background[1]
Inorganic Compounds (mg/kg): Aluminum	13/13	3,400 - 10,300	N/A	5,623.9	1,960 - 24,100
Arsenic	13/13	1.6 -15.7	N/A	3.8	0.46L - 63.9
Chromium	13/13	5.4 - 48.9	N/A	11.2	2.6 - 33.5
Iron	13/13	3,790 - 19,300	N/A	7,827.7	1,440 - 46,400
Manganese	13/13	75 - 162	N/A	110.7	7.6L - 49l

Notes:

[1] Data considers both Station-wide and Anthropogenic Background Samples
J - estimated value
L - estimated, biased low
U - not detected
NA - not applicable
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-2

**SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SHALLOW SUBSURFACE SOIL SAMPLE ANALYSIS
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background
Inorganic Compounds (mg/kg): Arsenic	2/2	0.69 - 0.86	NA	0.78	0.23J - 42.7

Notes:

J - estimated value
NA - not applicable
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-3

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SUBSURFACE SOIL SAMPLE ANALYSIS
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background
Inorganic Compound (mg/kg): Arsenic	9/9	1.1 - 5	NA	2.98	0.23J - 42.7
Iron	9/9	2,520J - 6,910J	NA	4,183.75	3,810 - 51,100J

Notes:

J - estimated value
NA - not applicable
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-4

**INCREMENTAL CANCER RISKS AND HAZARD INDICES
FOR CURRENT POTENTIAL HUMAN TRESSPASSER RECEPTORS
REASONABLE MAXIMUM EXPOSURE
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

	Tresspasser Receptors			
	Adults		Adolescents (7-15 yrs)	
Pathway	ICR	HI	ICR	HI
Surface Soil				
Ingestion	3.7×10^{-7}	0.07	4.2×10^{-7}	0.03
Dermal Contact	6.2×10^{-7}	0.02	2.6×10^{-7}	0.03
Total	9.9×10^{-7}	0.09	6.8×10^{-7}	0.06

Notes:

ICR - incremental cancer risk
HI - hazard index

TABLE 2-5

INCREMENTAL CANCER RISKS AND HAZARD INDICES
FOR FUTURE POTENTIAL RECEPTORS
REASONABLE MAXIMUM EXPOSURE VALUES
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Pathway	Receptors									
	Adult Residents		Young Child Residents (1-6 yrs.)		Adolescent Residents (7-15 yrs)		Construction Worker		Industrial/Commercial Worker	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Surface Soil										
Ingestion	2.5×10^{-6}	0.09	9.3×10^{-6}	0.86	2.8×10^{-6}	0.17	NE	NE	7.4×10^{-7}	0.02
Dermal Contact	4.2×10^{-6}	0.11	2.9×10^{-6}	0.19	3.5×10^{-6}	0.15	NE	NE	1.3×10^{-8}	0.004
Subtotal	6.7×10^{-6}	0.20	1.2×10^{-5}	1.1*	6.3×10^{-6}	0.32	NE	NE	7.5×10^{-7}	0.02
Shallow Subsurface Soil										
Ingestion	NE	NE	NE	NE	NE	NE	8.7×10^{-8}	0.01	NE	NE
Dermal Contact	NE	NE	NE	NE	NE	NE	3.0×10^{-8}	0.005	NE	NE
Subtotal	NE	NE	NE	NE	NE	NE	1.2×10^{-7}	0.02	NE	NE

TABLE 2-5 (Continued)

INCREMENTAL CANCER RISK AND HAZARD INDEX[1]
FOR FUTURE POTENTIAL RECEPTORS
REASONABLE MAXIMUM EXPOSURE VALUES
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Pathway	Receptors									
	Adult Residents		Young Child Residents (1-6 yrs.)		Adolescent Residents (7-15 yrs)		Construction Worker		Industrial/Commercial Worker	
	ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Subsurface Soil										
Ingestion	NE	NE	NE	NE	NE	NE	3.5×10^{-7}	0.13	NE	NE
Dermal Contact	NE	NE	NE	NE	NE	NE	1.2×10^{-7}	0.06	NE	NE
Subtotal	NE	NE	NE	NE	NE	NE	4.7×10^{-7}	0.19	NE	NE
TOTAL	6.7×10^{-6}	0.20	1.2×10^{-5}	1.1*	6.3×10^{-6}	0.32	5.9×10^{-7}	0.21	7.5×10^{-7}	0.02

Notes:
* Value exceeds 1.0 primarily because of iron (HQ = 0.46), arsenic (HQ = 0.32), and aluminum (HQ = 0.12)
Shaded values in table represent exceedences of USEPA acceptable risk criteria (i.e., target ICR range of 1×10^{-6} to 1×10^{-4} and target HI value of 1.0) by total site risk.

ICR - incremental cancer risk
HI - hazard index
NE - Pathway not evaluated for this receptor.

TABLE 2-6

INDIVIDUAL CHEMICAL CANCER RISKS AND HAZARD INDICES FOR FUTURE POTENTIAL RECEPTORS REASONABLE MAXIMUM EXPOSURE VALUES SITE 11 NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

Pathway	Chemical	Further Potential Receptors									
		Adult Residents		Young Child Residents (1-6 yrs.)		Adolescent Residents (7-15 yrs)		Construction Worker		Industrial/Commercial Worker	
		ICR	HI	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Surface Soil											
Ingestion	Aluminum	--	0.009	--	0.08	--	0.02	NA	NA	–	0.002
	Arsenic	2.5×10^{-6}	0.03	9.3×10^{-6}	0.24	2.8×10^{-6}	0.05	NA	NA	7.4×10^{-7}	0.004
	Chromium	--	0.005	--	0.04	--	0.009	NA	NA	–	0.0008
	Iron	--	0.05	--	0.42	--	0.09	NA	NA	–	0.008
	Manganese	--	0.008	--	0.07	--	0.01	NA	NA	–	0.001
Surface Soil											
Dermal Contact	Aluminum	--	0.02	--	0.04	--	0.03	NA	NA	–	0.0004
	Arsenic	4.2×10^{-6}	0.04	2.9×10^{-6}	0.08	3.5×10^{-6}	0.06	NA	NA	1.3×10^{-8}	0.00008
	Chromium	--	0.01	--	0.02	--	0.02	NA	NA	–	0.0002
	Iron	--	0.02	--	0.04	--	0.03	NA	NA	–	0.002
	Manganese	--	0.004	--	0.01	--	0.006	NA	NA	–	0.001
TOTAL		6.7×10^{-6}	0.20	1.2×10^{-5}	1.1	6.3×10^{-6}	0.33	NA	NA	7.5×10^{-7}	0.02

Notes:

Shaded values in table represent exceedences of USEPA acceptable risk criteria (i.e., target ICR range of 1×10^{-6} to 1×10^{-4} and target HI value of 1.0) by total site risk.

ICR - incremental cancer risk
NA - not applicable. No noncarcinogens selected as COPCs.

(AOC). Sample location outside of the Site 17 Soil AOC were referred to as Site 17 Proper. Therefore, risk results were generated for both Side 17 Soil AOC and Site 17 Proper.

TableS 2-7 through 2-11 present the COPCs evaluated in the human health RA for surface and subsurface soil AT Site 17. As presented on Table 2-12, there are no unacceptable carcinogenic risks or unacceptable HI values for current receptors (trespassers) potentially exposed to surface soil at Site 17 Soil AOC or Site 17 Proper.

Table 2-13 indicates that there is no unacceptable carcinogenic risk (total ICR = 1.6×10^{-5}) for future residents exposed to soil from Site 17 Proper. However, an unacceptable HI value of 2.7 indicates the potential for noncarcinogenic adverse health effects. An evaluation of the HI for Site 17 Proper indicates that the contaminants iron (HQ = 1.3) and manganese (HQ = 1.3) produce more than 96 percent of the unacceptable HI. However, iron and manganese concentrations detected at Site 17 Proper fall within the range of Station-wide surface soil background concentrations. This indicates that iron and manganese detected at Site 17 Proper may exist naturally and do not occur because of past disposal practices. These contaminants were, therefore, not evaluated as COCs because EPA generally does not require clean-up below natural background levels.

Unacceptable carcinogenic risk was calculated for future residents exposed to Site 17 Soil AOC surface soil. A total ICR of 2.1×10^{-4} was derived for residents living on or near the Site 17 Soil AOC for a thirty-year duration (Table 2-14). Total cPAHs are responsible for 99 percent of the unacceptable risk to future residents. As a result, the cPAHs were retained as COCs for evaluating remedial alternatives. An unacceptable HI value of 1.4 was also derived for the Site 17 Soil AOC because of manganese, iron, and arsenic. Concentrations of arsenic, manganese, and iron fall within the range of Station-wide surface soil background concentrations indicating that the presence of these contaminants is likely the result of natural occurrence. These contaminants were therefore, not evaluated as COCs because EPA generally does not require clean-up below natural background levelS.

TABLE 2-7

**SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACES SOIL SAMPLE ANALYSIS
SITE 17 PROPER
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background[1]
Organic Compounds (µg/kg): Benzo(a)pyrene	4/20	71J - 200J	340 - 520	191.10	140J - 180J
Inorganic compounds (mg/kg): Aluminum	20/20	2,360 - 7,950	NA	4,559	1,960 - 24,100
Arsenic	20/20	1 - 5.5	NA	2.49	0.46L - 63.9
Iron	20/20	2,150 - 12,300	NA	5,411	1,440 - 46,400
Manganese	20/20	16.5 - 266	NA	84.84	7.6L - 491

Notes:

(1) Data consider both Station-wide and Anthropogenic Background Samples

J - estimated value
L - estimated, biased low
U - not detected
NA - not applicable
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-8

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SHALLOW SUBSURFACE SOIL SAMPLE ANALYSIS
SITE 17 PROPER
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background
Inorganic Compounds (mg/kg):					
Arsenic	7/7	0.69 - 3J	NA	1.81	0.23J - 42.7
Iron	7/7	2,650J - 5,540J	NA	3594.29	3,810J - 51,100J

Notes:

J - estimated value
ND - not detected
NA - not applicable
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-9

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN FROM SURFACE SOIL SAMPLE ANALYSIS SITE 17 SOIL AREA OF CONCERN NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background[1]
Organic Compounds (µg/kg):					
Benzo(a)anthracene	4/4	160J - 6,500	NA	2,365.00	120J - 240
Benzo(a)pyrene	4/4	140J - 9,500	NA	3,235.00	140J - 180J
Benzo(b)fluoranthene	4/4	190J - 8,500	NA	3,197.50	230J - 500
Dibenzo(a,h)anthracene	3/4	160J - 1,700	NA	630.00	ND
Indeno(1,2,3-cd)pyrene	4/4	87J - 4,300	NA	1,486.75	160J
Inorganic Compounds (mg/kg):					
Arsenic	4/4	2.8 - 3.5	NA	3.15	0.466 - 63.9
Iron	4/4	4,220 - 7,380	NA	5,647.50	1,440 - 46,400
Manganese	4/4	97.8 - 194	NA	141.45	7.6L - 491

Notes:

(1) Data considers both Station-wide and Anthropogenic Background Samples

J - estimated value
L - estimated, biased low
NA - not applicable
ND - not detected
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-10

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN FROM SHALLOW SUBSURFACE SOIL SAMPLE ANALYSIS SITE 17 SOIL AREA OF CONCERN NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background
Organic Compounds (µg/kg): Benzo(a)anthracene	1/1	2,500	NA	2,500	NA
Benzo(a)pyrene	1/1	5,000	NA	5,000	NA
Benzo(b)fluoranthene	1/1	3,000	NA	3,000	NA
Dibenzo(a,h)anthracene	1/1	970	NA	970	NA
Indeno(1,2,3-cd)pyrene	1/1	2,700	NA	2,700	NA
Inorganic Compounds (mg/kg): Arsenic	1/1	1.4J	NA	1.4	0.23J - 42.7
Iron	1/1	2,560J	NA	2,560	3,810J - 51,100J

Notes:

J - estimated value
NA - not applicable
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-11

SUMMARY OF HUMAN HEALTH CONTAMINANTS OF POTENTIAL CONCERN
FROM SUBSURFACE SOIL SAMPLE ANALYSIS
SITE 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background
Organic Compounds (µg/kg): Benzo(a)pyrene	2/11	91J - 220J	360U - 440U	155.5	NA
Inorganic Compounds (mg/kg): Arsenic	11/11	0.9 - 3.5	NA	2.34	0.23J - 42.7
Iron	11 /11	2,100 - 7,500	NA	4,554.55	3,810 - 51,100J

Notes:

J - estimated value
U - not detected
NA - not applicable
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-12

**INCREMENTAL CANCER RISK AND HAZARD INDEX
FOR CURRENT POTENTIAL HUMAN TRESPASSER RECEPTORS
REASONABLE MAXIMUM EXPOSURE
SITE 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

	Trespasser Receptors			
	Adults		Adolescents (7-15 yrs)	
Pathway	ICR	HI	ICR	HI
Surface Soil-Site 17 Proper				
Ingestion	1.3×10^{-7}	0.002	7.2×10^{-8}	0.004
Dermal Contact	3.2×10^{-7}	0.04	1.3×10^{-7}	0.05
Subtotal	4.5×10^{-7}	0.04	2.0×10^{-7}	0.05
Surface Soil - Soil AOC				
Ingestion	1.9×10^{-6}	0.002	1.1×10^{-6}	0.004
Dermal Contact	3.8×10^{-7}	0.01	1.6×10^{-7}	0.02
Subtotal	2.3×10^{-6}	0.01	1.3×10^{-6}	0.02
Site 17 Total	2.8×10^{-6}	0.05	1.5×10^{-6}	0.07

Notes:

ICR - incremental cancer risk
HI - hazard index

TABLE 2-13

INCREMENTAL CANCER RISK AND HAZARD INDEX FOR FUTURE POTENTIAL RESIDENTIAL RECEPTORS REASONABLE MAXIMUM EXPOSURE VALUES SITE 17 PROPER NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

Pathway	Receptors						Total	
	Adults		Young Children (1-6 yrs.)		Adolescents (7-15 yrs)			
	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Surface Soil - Site 17 Proper								
Ingestion	1.7×10^{-6}	0.06	6.4×10^{-6}	0.52	2.0×10^{-6}	0.11		
Dermal Contact	2.2×10^{-6}	0.48	1.5×10^{-6}	0.84	1.8×10^{-6}	0.67		
Total	3.9×10^{-6}	0.54	7.9×10^{-6}	1.4	3.8×10^{-6}	0.78	1.6×10^{-5}	2.7*

Notes:

ICR - incremental cancer risk
HI - hazard index

Shaded HI value in table represent exceedences of USEPA acceptable risk criteria (target HI value of 1.0) by total site risk.

*Value exceeds 1.0 primarily because of cumulative risks due to iron (HQ=1.3) and manganese (HQ=1.3).

TABLE 2-14

**INCREMENTAL CANCER RISK AND HAZARD INDEX
FOR FUTURE POTENTIAL RESIDENTIAL RECEPTORS
REASONABLE MAXIMUM EXPOSURE VALUES
SITE 17 SOIL AREA OF CONCERN
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Pathway	Receptors						Total	
	Adults		Young Children (1-6 yrs.)		Adolescents (7-15 yrs)			
	ICR	HI	ICR	HI	ICR	HI	ICR	HI
Surface Soil - Soil AOC								
Ingestion	2.6×10^{-5}	0.06	9.7×10^{-5}	0.57	3.0×10^{-5}	0.12		
Dermal Contact [1]	2.6×10^{-6}	0.17	1.8×10^{-6}	0.30	1.8×10^{-6}	0.20		
Total	2.9×10^{-5}	0.23	9.9×10^{-5}	0.87	3.2×10^{-5}	0.32	2.1×10^{-4}*	1.42*

Notes:

ICR - incremental cancer risk
HI - hazard index

[1] Dermal contact with PAHs not evaluated as per USEPA Region III directive

Shaded values in table represent exceedences of USEPA acceptable risk criteria (i.e., target ICR range of 1×10^{-6} to 1×10^{-4} and target HI value of 1.0) by total site risk.

* The total ICR value exceeds 1×10^{-4} primarily because of cumulative risks due to benzo(a)pyrene (ICR = 1.0×10^{-4}) and dibenzo(a,h)anthracene (ICR = 1.9×10^{-5}). The total HI value exceeds 1.0 primarily because of cumulative risks due to iron (HI = 0.48), arsenic (HI = 0.30), and manganese (HI = 0.62).

Table 2-15 indicates that the future industrial/commercial workers who could be exposed to contaminants in surface soil at Site 17 Soil AOC and Site 17 Proper will not experience any unacceptable carcinogenic risk (ICR = 4.7×10^{-6}) or noncarcinogenic risk (HI = 0.02). Future construction workers (Table 2-16) who could contact contaminants in subsurface soil at Site 17 Soil AOC or Site 17 Proper also will not experience unacceptable carcinogenic risk (ICR = 4.3×10^{-6}) or noncarcinogenic adverse health effects (HI = 0.4) as a result of exposure.

TABLE 2-15

INCREMENTAL CANCER RISK AND HAZARD INDEX[(1)]
FOR FUTURE POTENTIAL COMMERCIAL/INDUSTRIAL WORKERS
REASONABLE MAXIMUM EXPOSURE VALUES
SITE 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

	Future Commercial/Industrial Worker	
Pathway	**ICR**	**HI**
Shallow Subsurface Soil -Site 17 Proper		
Ingestion	2.5×10^{-7}	0.11
Dermal Contact	8.9×10^{-8}	0.005
Shallow Subsurface Soil - Site 17 Proper Subtotal	3.4×10^{-7}	0.12
Shallow Surface Soil - Soil AOC		
Ingestion	3.5×10^{-6}	0.06
Dermal Contact	4.9×10^{-8}	0.03
Shallow Surface Soil - Soil AOC Subtotal	4.0×10^{-6}	0.09
Subsurface Soil - Site 17*		
Ingestion	3.9×10^{-7}	0.13
Dermal Contact	1.0×10^{-7}	0.064
Subsurface Soil - Site 17* Subtotal	4.9×10^{-7}	0.19
Total Site 17 Proper	3.4×10^{-7}	0.12
Total Site 17 AOC	4.0×10^{-6}	0.09
Site 17 Total	4.8×10^{-6}	0.40

Notes:

ICR - incremental cancer risk
HI - hazard index
* Includes both Site 17 Proper and Site 17 Soil AOC subsurface soil samples

TABLE 2-16

INCREMENTAL CANCER RISK AND HAZARD INDEX
FOR FUTURE POTENTIAL CONSTRUCTION WORKER RECEPTORS
REASONABLE MAXIMUM EXPOSURE VALUES
SITE 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

	Future Construction Worker	
Pathway	**ICR**	**HI**
Shallow Subsurface Soil -Site 17 Proper		
Ingestion	2.5×10^{-7}	0.11
Dermal Contact	8.9×10^{-8}	0.005
Shallow Subsurface Soil -Site 17 Proper Subtotal	3.4×10^{-7}	0.16
Shallow Surface Soil - Soil AOC		
Ingestion	3.5×10^{-6}	0.06
Dermal Contact	4.9×10^{-8}	0.03
Shallow Surface Soil - Soil AOC Subtotal	3.5×10^{-6}	0.09
Subsurface Soil - Site 17*		
Ingestion	3.9×10^{-7}	0.13
Dermal Contact	1.0×10^{-7}	0.064
Subsurface Soil - Site 17* Subtotal	4.9×10^{-7}	0.19
Total Site 17 Proper	3.4×10^{-7}	0.16
Total Site 17 AOC	3.5×10^{-6}	0.09
Site 17 Total	4.3×10^{-6}	0.40

Notes:

ICR - incremental cancer risk
HI - hazard index
* Includes both Site 17 Proper and Site 17 Soil AOC subsurface soil samples

2.7.1.3 Human Health RA Summary

The human health RA concluded that unacceptable cancer risks would not occur subsequent to surface soil, subsurface soil or sediment exposure at Site 11 under current or future exposure scenarios. The unacceptable HI generated for Site 11 surface soil exposure by future residents resulted from summing individual contaminant HQ values for differing target organs in the baseline human health RA. These HQs should not be summed for remedial action decision making purposes. Concentrations of arsenic, iron, aluminum, and chromium detected at Site 11 fall within Station-wide background surface soil concentrations. The EPA generally does not require clean up levels below natural background levels.

Future residents potentially exposed to cPAHs in surface soil from the Site 17 Soil AOC would experience unacceptable cancer risks. The cPAHs were retained as COCs for evaluating remedial alternatives. Unacceptable HI values generated for Site 17 were the result of summing HQ values that affect different target organs (and should, therefore, not be summed for decision making purposes) associated with inorganic contaminant concentrations that fall within Station-wide background concentration ranges. The EPA generally does not require clean up below natural background levels.

2.7.2 Ecological Risk Assessment

The objective of the ecological risk assessment was to evaluate whether past site operations have adversely affected the ecological integrity of the terrestrial community at Sites 11 and 17 and the aquatic community at Site 11. This is accomplished by a weight-of-evidence approach. Weight-of-evidence is the process by which contaminant concentrations are first compared to published toxicity information (Phase I) then evaluated by mathematical models to evaluate whether significant risk is posed to the environment (Phase II).

In Phase I, ecological HQs are derived for each chemical by dividing contaminant concentrations detected at the site by flora and fauna toxicity values (toxicity values for plants and animals respectively). Models are used in Phase II of the process. These mathematical models estimate the uptake of contaminants from ingestion of surface water, sediment, surface soil, plants, and/or prey to derive the body burden for each modeled organism. These body burdens are divided by published No Observable Effect Adverse Levels (NOEALs) and Lowest Observable Adverse Effect Levels (LOEALs) to get HQ values. In the weight-of-evidence approach used at WPNSTA Yorktown, unacceptable HQs (i.e., HQ $\geq$1.0) in both Phase I and Phase II indicates that the contaminant is an ecological COC unless concentrations are similar to Station-wide background. If site concentrations fall within the Station-wide background range or occur at concentrations similar to Station-wide background, the contaminant may not be selected as a COC. An unacceptable HQ in either Phase I or Phase II indicates that the contaminant is a possible ecological COC depending on the contaminants ability to bioaccumulate (the ability of a contaminant to build up in the tissue of a receptor) and a comparison to Station-wide background. HQs below 1.0 in both Phase I and Phase II means that the contaminant is not a COC. Tables 2-17 through 2-20 present the ecological COPCs for Sites 11 and 17. Results of the ecological RA are presented in the following sections.

2.7.2.1 Site 11 - Terrestrial Ecological Risk

Terrestrial receptors (i.e., land-dwelling organisms) considered in the ecological RA for Site 11 included soil flora and fauna including American robins, American woodcocks, marsh wrens, red-tailed hawks, deer mice, short-tailed shrews, and meadow voles. The terrestrial receptors were selected based on the type of habitat encountered at Site 11 to represent various food-chain levels that could exist at the site.

Chromium concentrations in surface soil demonstrated risks in Phase I at Site 11. However, only one chromium result exceeded the range of background concentrations and in general, chromium concentrations detected at Site 11 were similar to Station-wide background surface soil concentrations. Lead concentrations in surface soil produced a risk in Phase II, but not Phase I. A single detection of lead in Site 11 surface soil also exceeded Station-wide background at location 11SS10 (48.5 mg/Kg). Because chromium and lead concentrations are similar to Station-wide background surface soil concentrations and the EPA generally does not require cleanup below natural background levels, these contaminants were not considered to be COCs at Site 11.

Silver and zinc concentrations in surface soil produced an unacceptable risk in Phase I by exceeding only flora (plant) toxicity values. Silver and zinc did not, however, pose an unacceptable risk in Phase II. Silver and zinc concentrations are also similar to Station-wide background concentrations. Therefore, silver and zinc were not retained as soil COCs at Site 11.

TABLE 2-17

SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSIS
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Ecological Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detections Limits	Arithmetic Mean	Range of Station Background Concentrations
Organic Compounds (µg/kg): Bis(2-ethylhexyl)phthalate	1/13	120J	370U - 430U	190.38	ND
Nitramine Compounds (µg/kg): Amino-DNTs	3/13	71J - 590	0.25U	190	1J
TNT	1/13	370	250U	140	ND
Inorganic Compounds (mg/kg): Aluminum	13/13	3,400 - 10,300	NA	5,623.85	1,960 - 24,100
Antimony	1/13	1	0.69U - 1B	0.43	9.2L - 11L
Beryllium	1/13	0.47	0.22U - 0.26U	0.15	0.23J - 0.93
Chromium	13/13	5.4 - 48.9	NA	11.24	2.6 - 33.5
Copper	13/13	11.1 - 220	NA	45.5	1.2J - 24.4
Iron	13/13	3,790 - 19,300	NA	7,827.69	1,440 - 46,400
Lead	13/13	9.1 - 48.5	NA	25.88	2.1 - 43.1
Mercury	7/13	0.1 - 1.6	0.06U - 0.09B	0.21	0.05J
Nickel	13/13	3 - 9.2	NA	4.6	3.8J - 12.5
Silver	13/13	0.55 - 28	NA	6.67	1J - 2.1J
Vanadium	13/13	6.6 - 33.4	NA	12.8	5.2J - 64.7
Zinc	13/13	18.3J - 76.7J	NA	42.47	3.2KB - 48.4

Notes:

B - detected in laboratory method blank
J - estimated value
L - estimated, biased low
U - not detected
NA - not applicable
ND - not detected
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-18

**SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
FROM SEDIMENT SAMPLE ANALYSIS
SITE 11
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Ecological Contaminants of Potential Concern	Frequency of Detection	Range of Detected Concentrations	Range of Detection Limits	Arithmetic Mean	Range of Station Background Concentrations
Inorganic Compounds (mg/kg):					
Aluminum	5/5	2,590 - 5,850	NA	4,122	1,510 - 40,500
Cobalt	5/5	0.6 - 4.1	NA	2.24	3.8J - 15J
Silver	4/5	0.28 - 1.2	0.26U - 0.26U	0.70	2.2J - 2.2J
Vanadium	5/5	4.9 - 14.6	NA	9.52	4.8J - 67.6

Notes:

J - estimated value
U - not detected
NA - not applicable
mg/kg - milligrams per kilogram or parts-per-million

TABLE 2-19

SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN FROM SURFACE SOIL SAMPLE ANALYSIS SITE 17 PROPER NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

Chemical	Frequency of Detection	Range of Detected Concentrations	Range of Detected Limits	Arithmatic Mean	Range of Station Background[1]
Semivolatiles (μg/kg)					
Benzo(a)anthracene	5/20	45J - 260J	340 - 520	181.20	120J - 240J
Benzo(a)pyrene	4/20	71J - 200J	340 - 520	191.10	140J - 180J
Benzo(b)fluoranthene	8/20	48J - 290J	340 - 520	173.15	230J - 500J
Benzo(k)fluoranthene	5/20	41J - 140J	340 - 520	175.90	120J - 130J
Bis(2-ethylhexyl)phthalate	6/20	46J - 1,300	340 - 790	223.70	ND
Carbazole	2/20	23J - 65J	340 - 520	194.65	ND
Chrysene	8/20	39J - 300J	350 - 520	169.85	150J - 270J
Dibenzofuran	1/20	43J	340 - 1,600	201.90	ND
Fluoranthene	7/20	46J - 550	340 - 520	195.25	120J - 430
Indeno(1,2,3-cd)pyrene	3/20	54J - 110J	340 - 520	189.95	160J
Phenanthrene	3/20	61J - 640	340 - 520	228.30	ND
Pyrene	8/20	55J - 460	340 - 520	186.95	160J - 320J
Inorganics (mg/kg)					
Aluminum	20/20	2,360 - 7,950	NA	4,559	1,960 - 24,100
Chromium	20/20	2.9K - 15	NA	6.5	2.6 - 33.5
Copper	20/20	1.2 - 27.6	NA	4.1	1.2J - 24.4
Cyanide	3/20	0.2 - 0.26	0.15 - 0.24	0.11	ND

TABLE 2-19 (Continued)

SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSIS
SITE 17 PROPER
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Chemical	Frequency of Detection	Range of Detected Concentrations	Range of Detected Limits	Arithmatic Mean	Range of Station Background[1]
Inganics (mg/kg) (continued)					
Iron	20/20	2,150 - 12,300	NA	5,411	1,440 - 46,400
Lead	20/20	2.5 - 19.4	NA	9.2	2.1 - 43.1
Mercury	10/20	0.06 - 0.19	0.05 - 0.08	0.08	0.05J
Nickel	20/20	1.4 - 6.2	NA	3.10	3.8J - 12.5
Vanadium	20/20	6.4 - 19	NA	11.9	5.2J - 46.7
Zinc	17/20	4.5 - 39.9	8 - 13	15.30	3.2KJ - 48.4

Notes:

J - estimated value
K - estimated value, biased high
L - estimated value, biased low
NA - not applicable
ND - not detected
NE - not established
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

[1] Data considers both Station-wide and Anthropogenic Background Samples

TABLE 2-20

**SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSIS
SITE 17 - SOIL AREA OF CONCERN
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Chemical	Frequency of Detection	Range of Detected Concentrations	Range of Detected Limits	Arithmatic Mean	Range of Station Background
Semivolatiles (μg/kg)					
Acenaphthene	2/4	190J - 430J	340 - 520	257.50	ND
Acenaphthylene	2/4	1,200 - 2,800	340 - 790	1,148.75	ND
Anthracene	3/4	310J -1,100J	340 - 520	605.00	ND
Benzo(a)anthracene	4/4	160J - 6,500	NA	2,365.00	120J-240J
Benzo(a)pyrene	4/4	140J - 9,500	NA	3,235.00	140J-180J
Benzo(b)fluoranthene	4/4	190J - 8,500	NA	3,197.50	230J-500
Benzo(g,h,i)perylene	4/4	87J - 5,000	NA	1,711.75	ND
Benzo(k)fluoranthene	4/4	94J - 3,000	NA	1,078.50	120J-130J
Bis(2-ethylhexyl)phthalate	1/4	170J	340 -790	243.75	ND
Carbazole	2/4	170J - 540J	340 - 520	280.00	ND
Chrysene	4/4	180J - 7,600	NA	2,745.00	150J-270J
Dibenzo(a,h,)anthracene	3/4	160J - 1,700	340 - 520	630.00	ND
Dibenzofuran	1/4	380J	340 - 1,600	397.50	ND
Fluoranthene	4/4	310J - 5,900	NA	2,852.50	120J-130J
Fluorene	3/4	130J - 510J	340 - 520	307.50	ND
Indeno(1,2,3-cd)pyrene	4/4	87J - 4,300	NA	1,456.75	ND
2-Methylnaphthalene	2/4	48J - 94J	340 - 1,600	285.50	150J-270J
Naphthalene	1/4	390J	340 - 1,600	400.00	ND

TABLE 2-20 (Continued)

**SUMMARY OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSIS
SITE 17 - SOIL AREA OF CONCERN
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

Chemical	Frequency of Detection	Range of Detected Concentrations	Range of Detected Limits	Arithmatic Mean	Range of Station Background
Semivolatiles (µg/kg) (continued)					
Phenanthrene	4/4	220J - 4,400J	NA	1.822.50	ND
Pyrene	4/4	270J - 9,500	NA	3,592.50	160J-320J
Inorganics (mg/kg)					
Aluminum	4/4	4,100 - 5,230	NA	4,675.00	1,960-24,100
Beryllium	1/4	0.29	0.21 - 0.32	0.17	0.23J-0.93J
Chromium	4/4	5.7 - 9.4	NA	7.80	2.6-33.5
Cyanide	1/4	0.19	0.15 - 0.24	0.12	ND
Iron	4/4	4,220 - 7,380	NA	5,647.50	1,440-46,400
Lead	4/4	20.2 - 29	NA	24.83	2.1-43.1
Mercury	2/4	0.1 - 0.13	0.05 - 0.08	0.08	0.05J
Nickel	4/4	2.7 -4.5	NA	3.65	3.8J-12.5
Vanadium	4/4	9.3 - 14.6	NA	12.15	5.2J-64.7
Zinc	4/4	22.7 - 124	NA	51.38	3.2KJ-48.4

Notes:

J - estimated value
NA - not applicable
ND - not detected
µg/kg - micrograms per kilogram or parts-per-billion
mg/kg - milligrams per kilogram or parts-per-million

Copper concentrations produced unacceptable risks in both Phase I and Phase II of the ecological risk assessment. Copper was also detected in nine out of thirteen soil samples exceeding Station-wide background concentrations. The maximum copper concentration was detected at location 11SS10 (220 mg/Kg). Mercury concentrations in Site 11 soil also presented risks in Phase I and Phase II. Soil concentrations of mercury were detected above background in every sample. The maximum detected mercury concentration (1.6 mg/Kg) also occurred at soil sample location 11SS10.

Because copper and mercury pose the greatest potential to produce adverse ecological effects, these contaminants were retained as COCs at Site 11. These contaminants are localized in the vicinity of sample location 11SS10 where maximum concentrations for other contaminants not retained as COCs (lead, silver, and zinc) coincide with maximum detected copper and mercury concentrations. The remediation of this relatively small area will, therefore, produce the maximum benefit to potential ecological receptors at Site 11 with the smallest disturbance of the local ecology.

2.7.2.2 Site 11 - Aquatic Ecological Risk

Potential representative aquatic receptors considered in the Site 11 ecological RA included: sediment benthic macroinvertebrates (organisms that live in sediment), fish (including the largemouth bass), bullfrogs, and great blue herons. The aquatic receptors were selected to represent various food-chain levels that may exist downstream from the Site 11 drainage way.

The concentrations of contaminants detected in Site 11 sediment samples did not cause unacceptable risks in Phase I or Phase II and fall within the range of Station-wide background concentrations. Drainage ditch sediment was therefore not considered as a medium of concern at Site 11. Surface water could not be evaluated because the drainage area is usually dry (i.e., surface water flow is seasonal occurring during periods of heavy precipitation only) and water was not present in the drainage ditch during the field investigation.

2.7.2.3 Site 17 - Proper Terrestrial Ecological Risk

Aluminum, chromium, copper, iron, lead, mercury, and vanadium produced risks in Phase I or Phase II of the ecological risk assessment. Soil concentrations of aluminum, chromium, iron, lead, and vanadium, however, were detected within the range of Station-wide background soil concentrations. Copper concentrations were similar to Station-wide background. Aluminum, chromium, copper, iron, lead, and vanadium occur naturally at Site 17 and the EPA generally does not require cleanup below natural background levels.

Mercury exceeded Station-wide background in every soil sample obtained from Site 17. However, mercury does not pose an unacceptable risk in either Phase I or Phase II. Because mercury is present over a relatively widespread area, remediation of this contaminant would pose greater harm to the terrestrial environment than taking no action. Therefore, no remedial actions are proposed for mercury at Site 17 Proper.

2.7.2.4 Site 17 - Soil Area of Concern Terrestrial Ecological Risk

Although PAHs generate risk to human receptors, the ecological environment does not appear to be adversely affected by Site 17 Soil AOC PAH concentrations. PAHs did not produce unacceptable risks in either Phase I or Phase II of the ecological risk assessment. Soil concentrations of aluminum, chromium, iron, lead, and vanadium were detected below the Station-wide range of background soil concentrations and were not retained as COCs for the Site 17 Soil AOC.

Mercury was also detected at the Site 17 Soil AOC. The maximum detected mercury concentration posed unacceptable risks in Phase I but did not pose unacceptable risks in Phase II. One soil sample location contained zinc in excess of Station-wide background concentrations which posed risk only to flora and fauna and higher trophic levels. Because zinc was detected at concentrations similar to Station-wide background surface soil concentrations and the EPA generally does not require cleanup below natural background levels, zinc was not considered to be a soil COC. Zinc and mercury will, however, be remediated because maximum concentrations of these contaminants occur with PAHs at the Site 17 Soil AOC. Remediation of soil at the Site 17 Soil AOC to address human health risks will therefore benefit environmental receptors by removing the highest soil concentrations of mercury and zinc while producing the least disturbance of the local ecology.

2.7.3 Summary of Baseline RA Results

At Site 11, copper and mercury detected in surface soil pose unacceptable risk to terrestrial ecological receptors. This small area located in the south central portion of the site constitutes a soil hot spot (Figure 2-3) and removal of this hot-spot will be necessary to protect terrestrial ecological receptors.

Soil concentrations of cPAHs in the Site 17 Soil AOC (Figure 2-5) pose unacceptable human health risks to future residents. ICR values in excess of the generally acceptable target risk range of $1x10^{-6}$ to $1x10^{-4}$ are produced by cPAHs, which include: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3)pyrene.

Based on the results of human health and ecological RAs, it was determined that the copper/mercury-contaminated hot-spot at Site 11 and the cPAH-contaminated Site 17 AOC will require remediation to protect human health and the environment. Copper and mercury (Site 11) and cPAHs (Site 17) were determined to be COCs for the sites. Remediation levels (RLs) of 100 mg/Kg, 0.3 mg/Kg, and 10 mg/Kg were selected from final remediation goals (FRGs) developed in the FS for these contaminants, respectively. These RLs are presented in Table 2-21 and protect both human health and the environment.

2.8 <u>Description of Remedial Alternatives</u>

The DoN considered a range of potential remedial action alternatives (RAAs) for the remediation of approximately 45 cubic yards of copper/mercury contaminated soil from Site 11 and approximately 1300 cubic yards of cPAH contaminated soil from Site 17. The treatment alternative (RAA 4) requires that soil be excavated and treated off-site. A discount factor of five percent and a thirty year time-frame was used in the calculation of net present worth for each alternative. The following RAAs were evaluated:

- RAA 1: No Action
- RAA 2: No Action with Institutional Controls
- RAA 3: Soil Cover

TABLE 2-21

**SUMMARY OF REMEDIATION LEVEL (RL) VALUES
FOR SITES 11 AND 17 SOIL
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA**

Chemical of Concern	RL Value (mg/Kg)	Source
Total cPAHs[(1)]	10	Human[(2)]
Copper	100	Ecological[(3)]
Mercury	0.3	Ecological[(4)]

(1) Includes: benzo(a)pyrene; benzo(a)anthracene; chrysene; indeno(1,2,3-cd)pyrene; benzo(b) fluoranthene; benzo(k)fluoranthene; dibenzo(a,h)anthracene.
(2) Based on future commercial property use scenario.
(3) Based upon the flora toxicity benchmark value.
(4) Derived from uptake models used in Phase II of the ecological risk assessment.

- RAA 4: On-Site Treatment - Bioslurry
- RAA 5: Soil Excavation with Off-Site Disposal

2.8.1 RAA 1: No Action

Under the No Action RAA, copper and mercury-contaminated soil at Site 11 and PAH-contaminated soil at Site 17 would remain in place. No remedial efforts would be conducted to reduce the copper and mercury contamination at Site 11 or the total cPAH contamination at Site 17. No actions would be taken to reduce human and environmental contact with site contaminants. RAA1 is not protective of human health or the environment, but was evaluated to provide a baseline for comparison to other RAAs.

Because hazardous substances would remain at Sites 11 and 17 under this RAA, Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), requires that such remedial action be reviewed no less often than every five years after its initiation to ensure the protection of human health and the environment.

• Estimated Capital Cost:	$0
• Estimated Annual Operation and Maintenance (O&M) Costs:	$0
• Estimated Net Present Worth (NPW):	$0
• Estimated Implementation Time:	Immediate
• Estimated Time to Reach RLs:	Never

2.8.2 RAA 2: Monitoring with Institutional Controls

RAA 2 combines the no action alternative with monitoring and institutional controls. This remedy includes land use controls for Site 17 and implementing a soil sampling program at both Sites 11 and 17. The Navy will be responsible for implementing and maintaining land use controls at Site 17. At Site 17, soil samples would be collected annually and results would be used to determine if PAHs in the surface soil are degrading naturally. If increased copper/mercury concentrations or cPAH concentrations are detected in Site 11 or if Site 17 soil and indicate that natural degradation and attenuation of cPAHs are not occurring, RAA 2 would be re-evaluated and further action taken to protect human health and the environment.

Because hazardous substances would remain at both Sites 11 and 17 under this RAA, Section 121 (c) of CERCLA, 42 U.S.C. § 9621 (c), requires that such remedial action be reviewed no less often than every five years after its initiation to ensure the protection of human health and the environment.

- Estimated Capital Cost: $53,000
- Estimated Annual O&M Costs: $11,000
- Estimated NPW: $220,000
- Estimated Implementation Time: Less than one month
- Estimated Time to Reach RLs: Unknown

2.8.3 RAA 3: Soil Cover

RAA 3 includes installing a soil cover over the PAH-contaminated AOC at Site 17 and annual groundwater monitoring. Prior to the installation of soil cover, the copper/mercury-contaminated hot spot at Site 11 would be excavated and placed within the Site 17 PAH-contaminated AOC. Soil samples would be obtained from the excavated area to ensure that copper and mercury concentrations did not pose unacceptable risks to human health or the environment. In order to prevent contact with the copper/mercury-contaminated soil excavated from Site 11 and PAH-contaminated soil at 17, Site 11 excavated soil and the Site 17 Soil AOC would be covered with a clean soil cover. Topsoil would be installed on the soil cover and the area would be revegetated with native grasses. A long-term groundwater monitoring program would also be implemented to ensure that contaminants under the cover are not migrating to the underlying shallow aquifer. Monitoring wells would be sampled at Site 17 on an annual basis. This RAA also includes land use controls to protect the integrity of the soil cover, annual inspections and maintenance of the soil cover. The Navy will be responsible for implementing and maintaining land use controls at Site 17.

Because RAA 3 allows hazardous substances to remain at Site 17 under this RAA, Section 121 (c) of CERCLA, 42 U.S.C. § 9621 (c), requires this action be reviewed no less often than every five years after initiation to ensure the protection of human health and the environment. Land use controls would be established to prohibit future property use that could interfere with the soil cover at Site 17.

- Estimated Capital Cost: $163,000
- Estimated Annual O&M Cost: $11,600

- Estimated NPW: $325,000
- Estimated Implementation Time: Six months
- Estimated Time To Reach RLs: Immediately Upon Cover Installation

2.8.4 RAA 4: Excavation and Offsite Disposal (Site 11)/On-Site Treatment-Bioslurry (Site 17)

Under this RAA 4, approximately 1,300 cubic yards of PAH-contaminated soil exceeding the remediation goal of 10 mg/Kg at Site 17 would be excavated, loaded into dump trucks, and transported to an on-site bioslurry reactor (biocell). Samples would be taken from the Site 17 excavated area to confirm that cPAH-contaminated soil was adequately removed to protect human health and the environment. The Site 17 Soil AOC area would then be backfilled with clean soil covered with topsoil and revegetated. For this RAA, it is assumed that the existing biocell at Site 22 of WPNSTA Yorktown would be used. The PAH-contaminated soil would be placed in the biocell and mixed with nutrients, microbes, and water. The microbes can break down the PAHs into non-cancer causing compounds. The treated soil would be sampled and analyzed for PAHs and RCRA hazardous characteristics (ignitability, reactivity, and corrosivity). If the sample results show that the PAHs have decreased to acceptable concentrations and the soil is not hazardous by characteristics, the soil would be reused as fill at the Station. With respect to Site 11, approximately 45 cubic yards of copper/mercury-contaminated soil would be excavated and disposed at a permitted off-site facility. Site 11 would be backfilled with clean soil, covered with topsoil, and revegetated using native grasses. Land use controls would be established for Site 17 to prevent future residential use of the property. The Navy will be responsible for implementing and maintaining land use controls at Site 17.

- Estimated Capital Cost: $375,000
- Estimated Operation and Maintenance (O&M) Costs: $0
- Estimated NPW: $375,000
- Estimated Time to Implement: Six to twelve months
- Estimated Time to Reach RLs: Immediately (Site 11), 6 to 24 weeks (Site 17)

2.8.5 RAA 5: Excavation with Off-Site Disposal

RAA 5 includes the excavation of copper and mercury-contaminated soil at Site 11 and PAH-contaminated soil at Site 17. Excavated soil would be transported to an off site approved disposal facility (hazardous or non-hazardous landfill). Soil samples would be taken from both excavated areas and analyzed to confirm that all soil exceeding the remediation goals for copper, mercury, and total cPAH has been removed. The excavated area would be backfilled with clean soil and then covered with topsoil. The topsoil would be seeded with native grasses to revegetate the area to prevent erosion. Land use controls would be established for Site 17 to prevent future residential use of the property. The Navy will be responsible for implementing and maintaining land use controls at Site 17.

- Estimated Capital Cost: $250,000 (non-hazardous)
  $535,000 (hazardous)
- Estimated O&M Costs: $0
- Estimated NPW: $250,000 (non-hazardous)
  $535,000 (hazardous)
- Estimated to Implement: Three to Six months (assuming off-site landfill facility is available).
- Estimated Time to Reach RLs: Immediately

2.9 <u>Evaluation of Alternatives</u>

As required by CERCLA, the five RAAs were assessed against nine evaluation criteria specified by the USEPA (Table 2-22). This section and Table 2-23 summarize the detailed analysis of each alternative.

As part of the FS process, each of the RAAs was assessed against nine evaluation criteria which fall into three categories: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be met for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major trade-offs among alternatives. Generally, the modifying criteria are taken into account after public comments are received on the PRAP. The nine evaluation criteria include:

TABLE 2-22

USEPA EVALUATION CRITERIA FOR REMEDIAL ALTERNATIVES
SITES 11 AND 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

THRESHOLD CRITERIA:

- **Overall protection of human health and the environment**
  Addresses whether a cleanup method adequately protects human health and the environment and describes how risks presented by each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- **Compliance with ARARs**
  Addresses whether a cleanup method meets all ARARs (federal and state environmental requirements) and/or provides grounds for invoking a waiver.

PRIMARY BALANCING CRITERIA:

- **Long-term effectiveness and permanence**
  Refers to the ability of the cleanup method to reliably protect human health and the environment over time, after the action is completed.

- **Reduction of toxicity, mobility, or volume through treatment**
  Addresses the effectiveness of a cleanup method in reducing the toxicity, mobility, or volume of hazardous substances through treatment.

- **Short-term effectiveness**
  Addresses the period of time needed to complete the cleanup and any adverse impacts on human health and the environment that may occur during construction and operation.

- **Implementability**
  Refers to the technical and administrative feasibility of a cleanup method, including the availability of required materials and services.

- **Cost**
  Includes the estimated capital and O&M costs of each cleanup method.

MODIFYING CRITERIA:

- **State acceptance**
  Indicates whether the Commonwealth of Virginia agrees with the preferred cleanup method.

- **Community acceptance**
  Indicates whether public concerns are addressed by the cleanup method and whether the community has a preference. (Public comment is an important part of the final decision.)

TABLE 2-23

SUMMARY OF DETAILED ANALYSIS
SITES 11 AND 17
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Evaluation Criteria	RAA 1: No Action	RAA 2: No Action with Institutional Controls	RAA 3: Soil Cover	RAA 4: On-Site Treatment - Bioslurry	RAA 5: Excavation with Off-Site Disposal
Overall Protectiveness	• No reduction in risk to human health or the environment.	• Some reduction in risk to human health through awareness and prohibition against property use. No reduction risk to terrestrial receptors. • Will indicate if soil contamination is attenuating naturally.	• Will provide protection to human health and the environment by precluding contact with contaminated soil.	• Significant reduction in risk by removal and treatment of contaminated soil.	• Significant reduction in risk to both human health and the environment because contaminated soil is removed.
Compliance with ARARs	• Will not meet all ARARs.	• Will meet ARARs.	• Will meet ARARs.	• Will meet ARARs.	• Will meet ARARs.
Long-Term Effectiveness and Permanence	• Not effective and permanent	• Somewhat effective, but not permanent. • 5-year review required	• If properly maintained, soil cover will be effective and permanent. • 5-year review required	• Effective and permanent because the contaminated soil is treated (Site 17) • Site 11 soil (45 cubic yards) will be removed and disposed in a permitted off-site facility. • 5-year review required.	• Effective and permanent because contaminated soil is removed from the site and disposed in a permitted off-site facility. • 5-year review required.
Reduction of Toxicity, Mobility, or Volume Through Treatment	• Will not reduce toxicity, mobility, or volume of contaminants through treatment.	• Will not reduce toxicity, mobility, or volume of contaminants through statutory preference for treatment.	• Will not reduce toxicity, mobility, or volume of contaminants through statutory preference for treatment.	• Contaminated soil will be treated using biological methods (Site 17). • Site 11 soil will not be treated.	• Will not reduce toxicity, mobility, or volume of contaminants through statutory preference for treatment.

TABLE 2-23 (Continued)

SUMMARY OF DETAILED ANALYSIS
SITES 11 AND 17
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

Evaluation Criteria	RAA 1: No Action	RAA 2: No Action with Institutional Controls	RAA 3: Soil Cover	RAA 4: On-Site Treatment - Bioslurry	RAA 5: Excavation with Off-Site Disposal
Short-Term Effectiveness	• No short-term effects on human health and the environment.	• Some short-term effects on human health, but no effect on the environment.	• Risk to workers may increase because of potential contact with contaminated soil at Site 17.	• Risk to community and workers may increase due to fugitive dust caused by excavation activities at Site 17. • Possible risk to surrounding communities during off-site transportation of contaminated soil.	• Risk to community and workers may increase due to fugitive dust caused by excavation. • Possible risk to surrounding communities during off-site transportation of contaminated soil.
Implementability	• No remedial activities planned. Easily implemented.	• No remedial activities planned. Easily implemented.	• Easy to construct and maintain soil cover. • Equipment and materials readily available. • Requires long-term maintenance. • Immediate achievement of remedial action objectives/RLs.	• Uses proven method of biological treatment, but is more labor intensive and takes longer to implement than off-site disposal. • Routine construction operations. • Equipment and materials readily available. • Requires coordination with off-site disposal facility. • Achievement of remedial action objectives/RLs (Site 17) dependent of site conditions.	• Less labor intensive and takes less time to implement than on-site treatment. • Routine construction operations. • Equipment and materials readily available. • Requires coordination with off-site disposal facility. • Immediate acheivement of remedial action objectives/RLs.
Costs (NPW)	$0	$220,000	$325,000	$375,000	$250,000 (non-hazardous) $532,000 (hazardous)

Threshold Criteria

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria

- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume Through Treatment
- Short-Term Effectiveness
- Implementability
- Cost

Modifying Criteria

- State Acceptance
- Community Acceptance

2.9.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Evaluation of the overall protectiveness of alternatives focused on whether a specific alternative would achieve adequate protection of human health and the environment and how risks posed by each pathway would be eliminated, reduced, or controlled through treatment, engineering or institutional controls. The overall assessment of the level of protection included the evaluations conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

RAA 5 provides the greatest extent of protection for human health and the environment because it provides source control by removing and treating primary sources of contamination at Sites 11 and 17 (surface soil containing copper/mercury and cPAHs, respectively). RAA 5, therefore, provides a permanent solution for both sites. RAA 2 provides some protection to human health through awareness and prohibitions against property use at Site 17, but provides no protection for ecological receptors at

Sites 11 or 17. RAA 4 may be protective of both human health and the environment. However, biological treatment processes are not as effective on organic contaminant concentrations less than 50 mg/Kg and are ineffective on inorganic contaminants such as copper and mercury. RAA 1, No Action, does not include measures to protect human health or the environment. Because the no action alternative does not reduce potential risks to human health and the environment, it will not be evaluated further.

<u>Compliance with ARARs</u>

This evaluation involved determining whether each alternative will meet all of the pertinent Federal and state ARARs (as identified in Section 2.11.2 of this ROD).

Each alternative was evaluated for compliance with applicable or relevant and appropriate Federal and state requirements. The evaluation summarized which requirements are applicable or relevant and appropriate to each alternative. The following items were considered for each alternative:

- Compliance with chemical-specific ARARs (e.g., ambient water quality criteria). This factor addresses whether the ARARs can be met, and, if not, whether a waiver may be appropriate.

- Compliance with location-specific ARARs (e.g., preservation of historic sites, regulations relative to activities near wetlands or flood plains, etc.). As with other ARAR-related factors, these involve consideration of whether the ARARs can be met or whether a waiver is appropriate.

- Compliance with action-specific ARARs (e.g., RCRA minimum technology standards). It must be determined whether ARARs can be met or must be waived.

No chemical-specific ARARs apply to the remediation of Sites 11 and 17. RAAs 2, 3, 4 and will achieve all location-specific and action-specific ARARs.

2.9.2 Primary Balancing Criteria

Long-term Effectiveness and Permanence

This criterion evaluates alternatives with respect to their long-term effectiveness and the degree of permanence. The primary focus of this evaluation is the residual risk that will remain at the sites and the effectiveness of the controls that will be applied to manage residual risks. The assessment of long-term effectiveness was made considering the following four factors:

- The magnitude of the residual risk to human and environmental receptors remaining from untreated waste or treatment residues at the completion of remedial activities.

- An assessment of the type, degree, and adequacy of long-term management (including land use controls, monitoring, and operation and maintenance) required for untreated waste or treatment residues remaining at the site.

- An assessment of the long-term reliability of engineering and/or institutional controls to provide continued protection from untreated waste or treatment residues.

- The potential need for replacement of the remedy and the continuing need for repairs to maintain the performance of the remedy.

RAA 2 does not include the removal of soil and is not effective in reducing risks to ecological receptors. RAA 3 is protective of human health and ecological receptors, but the long-term effectiveness is a function of ongoing soil cover maintenance by WPNSTA Yorktown personnel. Long-term monitoring of underlying shallow groundwater could also determine that contaminants are migrating to other environmental media, requiring additional action. RAA 4 would likely not be effective because treatment would not reduce concentrations of cPAHs in Site 17 soil or inorganics in Site 11 soil to RLs. RAA 5 is permanent because cPAH-contaminated soil at Site 17 and copper/mercury-contaminated soil at Site 11 will be removed and transported to a permitted of site landfill for disposal. RAA 5 is permanent and effective.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the degree to which the alternatives employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. Alternatives that do not employ treatment technologies do not reduce toxicity, mobility, or volume of COCs. The evaluation considers the following specific factors:

- The treatment processes, the remedies that will be employed, and the materials that will be treated.
- The amount or volume of hazardous materials that will be destroyed or treated.
- The degree of expected reduction in toxicity, mobility, or volume, including how the principal threat waste, if any, is addressed through treatment.
- The degree to which the treatment will be irreversible.
- The type and quantity of treatment residuals that will remain following treatment.

RAA 4 is the only alternative that employs treatment as part of the alternative, and the effectiveness of a biological treatment alternative for cPAHs below 50 mg/Kg is questionable. Biological treatment will also be ineffective at reducing concentrations of copper/mercury in Site 11 soil. Treatment is not included under any of the other four RAAs considered for Sites 11 and 17.

Short-Term Effectiveness

The short-term effectiveness of each alternative is evaluated relative to its effect on human health and the environment during implementation of the remedial action. Potential threats to human health and the environment associated with handling, treatment, or transportation of hazardous substances are considered. The short-term effectiveness assessment can be based on four key factors:

- Short-term risks that might be posed to the community during implementation of an alternative.

- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures.

- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation.

- Time until remedial response objectives are achieved.

No additional risks to the community or workers will occur with RAA 2. Implementing RAA 3 may pose some risks to workers who could contact cPAHs soil during installation of the soil cover. Risks to workers and to the community could occur under RAAs 4 and 5. Dust associated with excavation activities could be released to the air. Additional risks to the community may occur under RAA 5 as copper/mercury-and cPAH-contaminated soil will be transported and disposed off-site. Excavation activities for both RAA 4 and RAA 5 may also create greater risk to environmental receptors because of erosion and habitat loss than those risks posed by leaving contaminants in place.

Of these RAAs, RAA 2 could be implemented most quickly (several weeks). Excavation activities for RAM 3 and 5 could be implemented within three months and remedial action objectives/RLs achieved immediately at the sites. Implementation of RAA 4 could require a treatability study which could take up to one year to complete. Achievement of remedial action objectives/RLs by RAA4 for Site 17 would depend on site conditions (i.e., weather, soil type, etc.). Earth moving activities for RAAs 3, 4 and 5 could be completed within six months. RAA 5, however, requires the availability of a permitted off-site disposal facility. Several permitted off-site disposal facilities are available for the implementation of RAA 5.

<u>Implementability</u>

Implementability considerations included the technical and administrative feasibility of each alternative and the availability of various materials and services required for its implementation. The following factors were considered during the implementability analysis:

- <u>Technical Feasibility</u>: The relative ease of implementing or completing an action based on site-specific constraints, including the use of established technologies, such as:

- Ability to construct the alternative as a whole (constructability).

- Operational reliability or the ability of a technology to meet specified process efficiencies or performance goals.

- Ability to undertake future remedial actions that may be required

- Ability to monitor the effectiveness of the remedy.

- Administrative Feasibility: The ability and time required to obtain any necessary approvals and permits from regulatory agencies

- Availability of Services and Materials: The availability of the technologies, materials, or services required to implement an alternative, including:

    - Available capacity and location of needed treatment, storage, and disposal services.

    - Availability of necessary equipment, specialists, and provisions for necessary additional resources.

    - Timing of the availability of prospective technologies under consideration.

    - Availability of services and materials, plus the potential for obtaining bids that are competitive (this may be particularly important for innovative technologies).

All of the RAAs are technically feasible. Conventional equipment and construction practices are required for implementation, operation, and monitoring under each alternative. From a technical standpoint, RAA 2 will be the easiest alternative to implement. RAAs 3, 4, and 5 require commonly-used soil excavation and/or earthmoving activities. RAA 5 requires commonly-used soil excavation and hauling activities and the availability of an off-site permitted disposal facility.

Services and materials required for each alternative are readily available. Permits may be required for off-site disposal, and disposal facilities are available to accept contaminated soil from Sites 11 and 17. A vendor is not currently available for service for biological treatment described in RAA 4.

Cost

For each RAA, a cost estimate was developed based on conceptual engineering and analyses. Unit prices were based on published construction cost data, quotes from vendors and contractors, and/or engineering judgment. Costs were expressed in terms of 1998 dollars. In order to allow the costs of remedial alternatives to be compared on the basis of a single figure, the net present worth (NPW) value of capital and annual costs was determined for each RAA. The USEPA CERCLA RI/FS Guidance Document recommends that a 5 percent discount rate be used in present worth analyses. A thirty year time period was used to calculate NPWs for all alternatives.

Of the RAAs, RAA 2 has the lowest NPW at $220,000. RAA 5 is next lowest if contaminated soil is nonhazardous. Under the nonhazardous scenario, the NPW for RAA 5 is $250,000. If all soil excavated from Sites 11 and 17 is hazardous, the NPW for Site 5 could be as high as $535,000. The NPW for RAA 3 is $325,000 including limited long-term maintenance costs. The NPW for RAA 4 is $375,000, but depends on a vendor's requirements for a treatability study prior to implementing field-scale biological treatment. Table 2-24 presents the detailed costs for RAAs.

2.9.3 Modifying Criteria

State Acceptance

The Commonwealth of Virginia was involved in the selection of the remedy for Sites 11 and 17. Information regarding remedy selection was conveyed through Restoration Advisory Board (RAB) meetings, the FS Report, the WPNSTA Yorktown Partnering meetings, and at the public meeting held after issuance of the Proposed Plan. No Commonwealth comments were received disputing the final remedy. The Commonwealth is satisfied that the appropriate process was followed in evaluating the RAAs for Sites 11 and 17 and concurs with the selected remedy.

TABLE 2-24

**COST ESTIMATE SUMMARY FOR
REMEDIAL ACTION ALTERNATIVE 5: SOIL EXCAVATION WITH OFF-SITE DISPOSAL
SITES 11 AND 17
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**

NON-HAZARDOUS CONTAMINANTS

Cost Component	Estimated Cost
Direct Capital Costs:	
• General Pre-Construction and Post-Construction Items	$50,000
• Mobilization/Demobilization	$20,000
• Site Work - Temporary Fencing, Clearing, Grading, Seeding	$24,035
• Soil Excavation - 1,345 cubic yards (Sites 11 and 17)	$2,408
• Confirmation Sampling	$9,500
• Site Restoration - Backfill and Topsoil	$10,638
• Off-site Disposal and Transportation - 1,480 tons	$89,040
TOTAL DIRECT CAPITAL COSTS	$205,621
INDIRECT CAPITAL COSTS:	
Engineering and Contingencies	$43,180
TOTAL CAPITAL COSTS	$250,000

HAZARDOUS CONTAMINANTS

Cost Component	Estimated Cost
Direct Capital Costs:	
• General Pre-Construction and Post-Construction Items	$50,000
• Mobilization/Demobilization	$20,000
• Site Work - Temporary Fencing, Clearing, Grading, Seeding	$24,035
• Soil Excavation - 1,345 cubic yards	$2,408
• Confirmation Sampling	$9,500
• Site Restoration - Backfill and Topsoil	$10,638
• Off-site Disposal and Transportation - 1,480 tons	$325,240
TOTAL DIRECT CAPITAL COSTS	$441,821
INDIRECT CAPITAL COSTS:	
Engineering and Contingencies	$92,782
TOTAL CAPITAL COSTS	$535,000

Community Acceptance

WPNSTA Yorktown solicited input from the public on the development of alternatives and on the alternatives identified in the Proposed Plan. A public meeting on the Proposed Plan was held on May 20, 1999. Community members in attendance during the public meeting asked some questions about the alternatives including the preferred alternatives and appeared to be satisfied with the Navy's response. No additional information on the Proposed Plan has been requested and the 45-day public comment period closed on June 30, 1999, with no additional comments being received on the selection of a remedy.

2.10 Selected Remedy

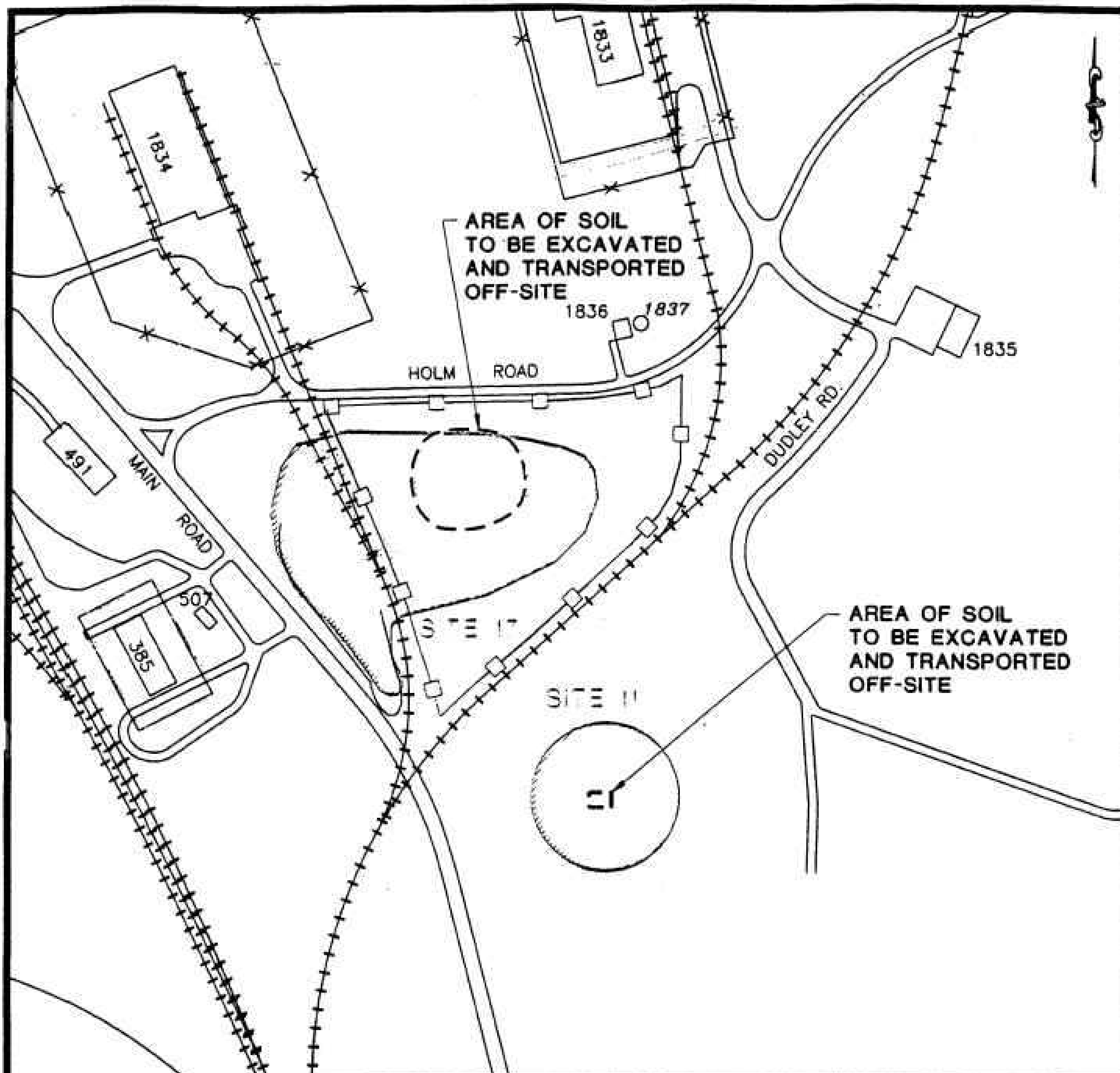
The selected remedy for the clean-up of copper/mercury-contaminated soil at Site 11 and cPAH contaminated soil at Site 17 is RAA 5. This RAA is protective of human health and the environment; complies with all ARARs; has a high degree of short-term and long-term effectiveness and permanence. Under this RAA, the soil contamination at both sites will be removed and disposed of off-site. Confirmational soil samples will be collected and analyzed. After an evaluation of the confirmation sample results, excavation at Site 11 and Site 17 will be backfilled, covered with topsoil, and re-seeded. Figure 2-7 identifies the major components of the selected remedy for Site 11 and Site 17.

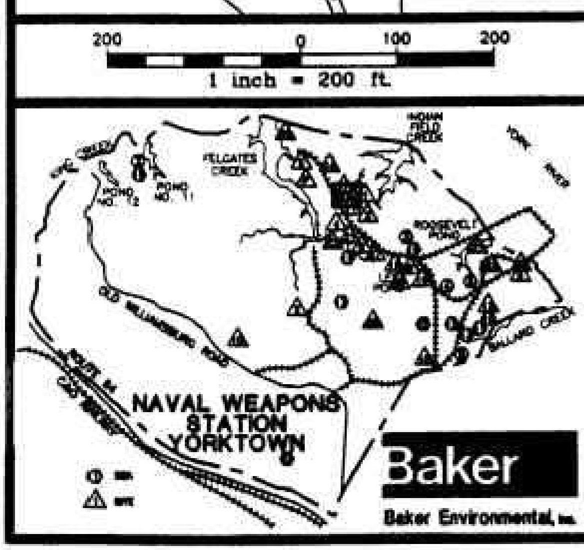
The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. RAA 5 will be more cost-effective (unless soil is a hazardous waste), will be less labor intensive and take less time to implement than RAA 4, and will utilize permanent solutions more so than RAA 3. The selected remedy will not, however, meet the statutory preference for treatment as a principal element.

Table 2-24 presents a summary of the cost estimates developed for Sites 11 and 17 RAA 5.

2.11 Description of Selected Remedy and Performance Standards

The selected remedy (RAA 5) involves the excavation and off-site disposal of soil contaminated with copper and mercury at Site 11 and soil contaminated with cPAHs at Site 17. Soil at Site 11 containing copper concentrations greater than 100 mg/Kg and mercury concentrations greater than 0.3 mg/Kg will be excavated and disposed off-site. Soil containing total cPAHs in excess of 10mg/Kg at Site 17 will





DRAINAGE
EDGE OF PAVEMENT
RAILROAD
FENCE
BUILDING
APPROXIMATE SITE AREA
TEMPORARY SAFETY FENCING

35470390

FIGURE 2-7
SITES 11 AND 17 RAA 5:
SOIL EXCAVATION WITH
OFF-SITE DISPOSAL

NAVAL WEAPONS STATION YORKTOWN | YORKTOWN, VIRGINIA also be excavated and disposed off-site. RLs for both Sites 11 and 17 are presented in Table 2-21. The excavated soil will be tested to determine if it is hazardous by characteristic in accordance with the RCRA regulations at 40 C.F.R. Part 261, Subpart C. If the excavated soil is determined to be hazardous waste by characteristic, it will be stored on-site in accordance with 40 C.F.R. Part 264, Subpart I, prior to being transported to an off-site disposal facility permitted under RCRA, 42 U.S.C. § 6925, and in compliance with the RCRA regulations at 40 C.F.R. Part 264. If the soil is non-hazardous, it will be sent to an appropriate disposal facility. An estimated 45 cubic yards of copper/mercury-contaminated soil and 1,300 cubic yards of PAH-contaminated soil will be excavated. During the excavation activities, a series of confirmatory soil samples will be collected and analyzed for PAHs at Site 17 and copper and mercury at Site 11 to determine the extent of excavation.

Site restoration activities will include backfilling, the addition of topsoil, and revegetation to restore the habitat at Sites 11 and 17.

WPNSTA Yorktown shall prohibit the future residential use of Site 17. This is the "land use control objective" for the site. The precise boundaries of the area in which residential use is prohibited shall be fixed during the development of the Land Use Control Implementation Plan described in the next paragraph.

Within 90 days following the execution of this ROD, WPNSTA Yorktown shall develop a Land Use Control Implementation Plan (LUCIP) with the concurrence of USEPA Region III and in consultation with the Commonwealth of Virginia. The LUCIP shall include:

(1) a description and the location of Site 17, including a map, a description of its approximate size, and a description of the contaminants of concern;

(2) the land use control (LUC) objectives selected above;

(3) the particular controls and mechanisms to achieve these objectives;

(4) a reference to this ROD; and

(5) any other pertinent information.

The DoN, with the concurrence of USEPA Region III and in consultation with the Commonwealth of Virginia, is developing a Land Use Memorandum of Agreement (MOA) for WPNSTA Yorktown. The completed MOA will contain Station-wide periodic inspection, condition certification, and agency notification procedures designed to ensure the maintenance by Navy personnel of any site-specific LUCs deemed necessary for future protection of human health and the environment, including LUCs selected in this ROD. A fundamental premise underlying execution of the MOA is that through the DoN's substantial good-faith compliance with procedures called for therein, reasonable assurances will be provided to USEPA and the Commonwealth of Virginia as to the permanency of those remedies which include the use of specific LUCs.

Although the terms and conditions of the MOA will not be specifically incorporated in or made enforceable as to this or any other ROD, it is understood and agreed by the DoN, USEPA, and the Commonwealth of Virginia that the contemplated permanence of the remedy reflected herein shall be dependent upon the Station's good-faith compliance with specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the environment.

2.12 Statutory Determinations

The selected remedy (RAA 5) for Sites 11 and 17 satisfies the requirements under Section 121 of CERCLA to :

- Protect human health and the environment
- Comply with ARARs
- Use permanent solutions and treatment technologies/resource recovery technologies to the maximum extent practicable
- Satisfy the preference for treatment as a principle element to the extent practicable.

2.12.1 Overall Protection of Human Health and the Environment

RAA 5 will provide a significant reduction in risks to human health and the environment at Sites 11 and 17 through the removal ofthe soil contaminants (copper/mercury and cPAHs). As such, this alternative will provide protectiveness to human health and the environment. The potential source of contamination to other environmental media will be removed under this alternative.

2.12.2 Compliance with ARARs

The selected remedy, RAA 5, complies with all Federal and State location- and action-specific ARARs as outlined below. Chemical specific ARARs and to-be-considered criterion (TBCs) are not available for soil. Therefore, risk-based RLs were developed for copper, mercury, and cPAH-contaminated soil that are protective of both human health and the environment.

<u>Location-Specific ARARs</u>

- **Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm) (32 CFR Part 229; 43 CFR Part 7)**

  Archaeological resources encountered during excavation must be reviewed by Federal and Commonwealth archaeologists to determine ifsuch resources should be preserved. The WPNSTA Yorktown Environmental Directorate will be contacted and Draft Historic Preservation Plan for WPNSTA Yorktown (U.S. Army Corps of Engineers, 1990) will be reviewed prior to development of the Remedial Action Work Plan to determine if archaeological resources are likely to be present at Sites 11 and 17.

- **Executive Order 11990, Protection of Wetlands**
  (40 CFR Part 6, Appendix A, excluding Sections 6(a)(2), 6(a)(4), 6(a)(6), and 6(c); 40 CFR § 6.302(a))

  Requirement to minimize the destruction, loss, or degradation of wetlands that could be caused by a remedial action. Although no wetlands exist at Site 11 or Site 17, erosion from excavation activities at either site could migrate to wetlands near Indian

Field Creek. An erosion control plan will be established as part of the Remedial Action Work Plan for Sites 11 and 17 prior to the initiation of excavation activities.

- **Clean Water Act, Section 404 (33 U.S.C. § 1344)**
  (40 CFR § 230.10; 40 CFR § 231 (231.1, 231.2, 231.7, 231.8))

  Section 404 of the Clean Water Act prohibits the discharge of dredged or fill material into a wetland without a permit. CERCLA on-site actions do not require a permit, but substantive requirements of Section 404 regarding such a discharge are an ARAR. No material taken from either Site 11 or Site 17 will be discharged or placed into wetlands.

- **National Historic Preservation Act, Section 106**
  (36 CFR Part 800)

  Historical resources potentially affected by remediation must be evaluated prior to construction activities. The WPNSTA Yorktown Environmental Directorate will be contacted and Draft Historic Preservation Plan for WPNSTA Yorktown (U.S. Army Corps of Engineers, 1990) will be reviewed prior to the development of the Remedial Action Work Plan to determine if historical resources are likely to be present at Sites 11 and 17

- **Virginia Wetlands Regulation**
  (VR 450-01-0051 §§ 1-5; 4 VAC 20-390-10 to -50)

  Regulates activities that impact wetlands. RAA 5 will be undertaken in such a way as to limit potential impacts on wetlands via erosion from Site 11 and Site 17 during excavation activities.

Action-Specific ARARs

- **Resource Conservation and Recovery Act (RCRA), Subtitle C (Hazardous Waste Management) (42 U.S.C. §§ 6921-6939e)**

  Applicable to any action at WPNSTA Yorktown involving treatment, storage, or disposal of hazardous waste.

  \- Identification and Listing of Hazardous Waste
  (40 CFR Part 261)
  Under RCRA, contaminated soils at Sites 11 and 17 are not considered hazardous by listing, but may exhibit hazardous characteristics. Any wastes hazardous by characteristic must be identified as part of RAA5 to determine appropriate on-site storage procedures and to select an appropriate off-site disposal facility. If the waste is determined to be hazardous by characteristic, the off-site disposal facility must be permitted under RCRA, 42 U.S.C § 6925, and in compliance with the RCRA regulations at 40 C.F.R. Part 264.

  Analytical methods used to identify hazardous waste by characteristic will be included in the approved Remedial Action Work Plan.

  \- Use and Management of Containers
  (40 CFR Part 264, Subpart I)
  Regulates the use and management of containers of hazardous waste being stored at hazardous waste facilities. Remediation may generate containerized waste, such as investigation derived waste (IDW) associated with confirmatory sampling and the excavated soil. If this waste is determined to be hazardous waste under RCRA and is stored in containers before being disposed of off-site, the use and management of such containers stored on-site must be in compliance with 40 C.F.R Part 264, Subpart I.

- **Virginia Hazardous Waste Management Regulations (VR 672-10-1 et seq; 9 VAC 20-60-10 et seq.)**

  Regulates the treatment, storage, and disposal of hazardous waste.

  \- Identification and Listing of Hazardous Wastes
  (VR 672-10-1 §§ 3-3.12; 9 VAC 20-60-100 to - 220)
  Under the Virginia Hazardous Waste Management Regulations, contaminated soils at Sites 11 and 17 are not considered to be hazardous by listing, but may exhibit hazardous characteristics. Any wastes hazardous by characteristic must be identified as part of RAA 5 to determine appropriate on-site storage procedures and to select an appropriate off-site disposal facility. If the waste is determined to be hazardous by characteristic, the off-site disposal facility must be permitted and in compliance with all applicable requirements under the Virginia Hazardous Waste Management Regulations.

  \- Use and Management of Containers
  (VR 672-10-1 § 10.8; 9 VAC 20-60-820)
  Regulates the use and management of containers of hazardous waste being stored at hazardous waste facilities. Applies where the IDW associated with confirmatory sampling and the excavated soil is determined to be hazardous and is stored in containers on-site before being properly disposed off-site.

- **Virginia Erosion and Sediment Control Regulations (VR 625-02-00 §§ 1-11; 4 VAC 50-30-1- to - 110)**

  Applicable to remedial actions involving land disturbing activities. Activities associated with the excavation at Sites 11 and 17 will have an erosion control plan as part of the Remedial Action Work Plan submitted to Atlantic Division, Naval Facilities Engineering Command (LANTDIV) and the Commonwealth of Virginia Department of Environmental Quality for approval prior to the initiation of excavation activities.

2.12.3 Cost Effectiveness

Because soil at Sites 11 and 17 will likely be nonhazardous by characteristic, RAA 5 is the most cost effective alternative and protective. It provides maximum short-term and long-term protection of human health and the environment, and unlike RAA 4, is not dependent on treatment efficacy for successful implementation.

2.12.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy for Sites 11 and 17 uses permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy requires the removal and off-site disposal of contaminated soil, which is a permanent solution. However, the types of contaminants, volume of contaminated material, and contaminant concentrations do not justify the costs and other implementation factors associated with a treatment option.

2.12.5 Preference for Treatment as a Principal Element

The selected remedy for Sites 11 and 17 does not satisfy the preference for treatment as a principal element. Contaminant types, volume of contaminated material, and concentrations encountered at both sites were evaluated in the FS, which identified the off-site disposal RAA as representing the best balance of all evaluation criteria, including costs.

2.13 Documentation of Significant Changes

The PRAP presents the selected remedy as the preferred alternative for Sites 11 and 17. No significant changes to the remedy have been made since the time it was presented as the preferred alternative in the PRAP.

3.0 RESPONSIVENESS SUMMARY

The final component of this Record of Decision is the Responsiveness Summary. The purpose of this section is to provide a summary of the public's comments, concerns, and questions about Sites 11 and 17.

During the public comment period, written comments, concerns, and questions were solicited. A public meeting was held on May 20, 1999, at the Charles E. Brown Community Building to formally present the Proposed Remedial Action Plan and to answer questions and receive comments. The transcript of this meeting is presented in Appendix A of this ROD. All comments concerning the remedy have been considered by the DoN and USEPA in the selection of the remedial alternatives for Sites 11 and 17.

The Responsiveness Summary is divided into the following sections:

- Overview
- Background on community involvement
- Summary of comments received during the public comment period

3.1 Overview

At the time of the public meeting on May 20, 1999, the DoN had endorsed a preferred alternative in the PRAP for the cleanup of copper- and mercury- contaminated soil at Site 11 and for the cleanup of cPAH-contaminated soil at Site 17 at WPNSTA Yorktown. The Site 11 alternative required excavation of copper- and mercury-contaminated soil at concentrations above an RL of 100 mg/Kg for copper and 0.3 mg/Kg for mercury and the restoration of the excavated area. The Site 17 alternative required excavation of cPAH-contaminated soil at concentrations above the RL of 10 mg/Kg. The excavated soil from both sites would be transported off-site to an approved disposal facility. Members of the community asked questions about the preferred alternatives and appeared to be satisfied with the Navy's response. USEPA Region III and the Commonwealth of Virginia concurred with the preferred alternatives for both sites. The community also agrees with the selection of the preferred alternative.

3.2 Background on Community Involvement

Nearby communities have a good working relationship with WPNSTA Yorktown because the Station maintains a good neighbor policy through the Public Affairs Office. WPNSTA Yorktown participates in community events and celebrations to foster close ties with the community. As part of the ongoing Community Relations Program (CRP), community interviews were conducted in 1991 to inform the community of the IR Program and solicit feedback on the listing of WPNSTA Yorktown as an NPL site. The community expressed concern about three issues: water resources, cleanup funding, and information availability/validity. This public openness has been maintained by the Public Affairs Office and the Environmental Directorate at WPNSTA Yorktown through the CRP and resulted in the formation of the Restoration Advisory Board. The WPNSTA RAB is comprised of agency representatives, technical and business persons, and members of the community at large. The RAB meets regularly, and progress at sites such as Sites 11 and 17 is discussed from the work plan stage to selection of the remedial alternative (if necessary). Preliminary RI results for Sites 11 and 17 were discussed at past and the most recent RAB meetings.

3.3 Summary of Comments Received During the Public Comment Period

The public comment period on the PRAP began on May 16, 1999, and ended on June 30, 1999. No comments were received from the public during the public comment period. A copy of the final PRAP is presented in Appendix B.

4.0 REFERENCES

Baker Environmental, Inc. 1999. Final Feasibility Study, Sites 11 and 17, Naval Weapons Station Yorktown, Yorktown, Virginia. May 1999.

Baker Environmental, Inc. 1998. Final Round Two Remedial Investigation Report, Sites 11 and 17, Naval Weapons Station Yorktown, Yorktown, Virginia. August 1998.

Baker Environmental, Inc. and Roy F. Weston, Inc. (Baker/Weston). 1993. Final Round One Remedial Investigation Report for Sites 1-9, 11, 12, 16-19, and 21, Naval Weapons Station, Yorktown, Virginia. July 1993.

C.C. Johnson & Associates, Inc. And CH2M Hill. 1984. Initial Assessment Study of Naval Weapons Station, Yorktown, Virginia. July 1984.

Dames & Moore. 1989. Draft Remedial Investigation Interim Report, Naval Weapons Station, Yorktown, Virginia. February 1989.

Dames & Moore. 1988. Confirmation Study Step IA (Verification), Round Two, Naval Weapons Station, Yorktown, Virginia. June 1988.

Dames & Moore. 1986. Confirmation Study Step IA (Verification), Round One, Naval Weapons Station, Yorktown, Virginia. June 1986.

Department of the Navy (DoN). 1991. The Master Plan for the U.S. Naval Weapons Station, Yorktown. Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia.

Federal Facility Agreement under CERCLA Section 120 (FFA). 1994. United States Environmental Protection Agency, Commonwealth of Virginia, and the United States Department of the Navy. Administrative Docket Number: III-FCA-CERC-009. August 4, 1994.

Versar. 1991. Remedial Investigation Interim Report, Naval Weapons Station, Yorktown, Virginia. July 1991.

APPENDIX A
Transcript of Public Meeting

NAVAL WEAPONS STATION

YORKTOWN

PROPOSED REMEDIAL ACTION PLAN

BRIEFING FOR SITES 11 & 17:

OPERABLE UNITS (OUs) XVIII AND XIX

<u>TRANSCRIPT OF PROCEEDINGS</u>

Lackey, Virginia

May 20, 1999

Appearances:

Richard F. Hoff, Activity Coordinator
Scott R. Park, Navy Technical Rep
Jeffrey C. Harlow, NWS Yorktown
Robert Stroud, EPA
Stephen Mihalko, DEQ
Kaye Phillips, Public Affairs Officer
David Nelms, USGS

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P R O C E E D I N G S

MS. PHILLIPS: We’ve started a sign-in sheet as usual and it should be over there somewhere, going around. Make sure you get signed in tonight so we have an accurate record of who was here.

Tonight Captain Cosper could not be with us. He had an unexpected thing he had to attend this evening. And so in place he sent the XO for the Atlantic Ordnance Command; this is Commander Renfro. And Captain Cosper said I could say that this is the man that has the facility that’s responsible for all the hazardous waste and why we have these meetings. So this is the man you can see because he has all the responsibility of ordnance now. Not that these things were done during these tenure, but he now has that problem. So it’s his facilities that we’re trying to do the cleanup under.

So welcome, Commander Renfro. And do you have anything you’d like to say?

COMMANDER RENFRO: No, that’s okay. You’ve done well.

MS. PHILLIPS: And then Jay, do you have --

MR. DEWING: I don’t have anything, not this evening.

MS. PHILLIPS: Well, why don't we go around since Commander Renfro, this is his first time and it will be a good learning experience for him to meet all of you that are part of the RAB committee and also let him start getting indoctrinated to what the whole RAB program is all about and what this committee does.

So if you just want to introduce yourselves around.

MR. MIHALKO: I'm Steve Mihalko with the Virginia Department of Environmental Quality, and project manager for the site.

MR. STROUD: My name is Bob Stroud. I'm with the Environmental Protection Agency.

MR. RAFKIND: Chuck Rafkind, with the National Park Service.

MR. MOSS: Barry Moss, Newport News citizen.

MS. ROGERS: Elizabeth Rogers, Chesapeake Bay York Chapter.

MR. PARK: Scott Park, I'm the Virginia Project Manager for Naval Facilities Engineering Atlantic.

MR. DEWING: Jay Dewing, I'm the cochairman from North County.

MR. NELMS: I'm David Nelms, from the U.S. Geological Survey.

MR. HARLOW: Jeff Harlow, Naval Weapons Station Yorktown coordinator.

MR. HOFF: I'm Rich Hoff, I'm the activity coordinator from Baker Environmental.

MS. PHILLIPS: Okay. Now, tonight the first item that we're going to talk about -- in fact, Rich is going to be covering that, sites 11 and 17 are being looked at now and the proposed remedial action plans for those sites.

I think -- did they get copies of the information that you gave me?

MR. HARLOW: At least you got the announcements. Did you not get any announcements for that?

MS. ROGERS: No.

MR. HARLOW: We have a copy. And it's open for about two months or about a month and a half for the comment period.

MR. PARK: The agenda says sites 1 and 3 and it's really 11 and 17.

MR. HARLOW: I just did that to confuse everybody to see if you'd show up tonight.

MS. ROGERS: I had a good time with sites

1 and 3.

MR. RAFKIND: I came from 1 and 3.

MS. PHILLIPS: So now you can find out what is going to happen at sites 11 and 17.

So, Rich, I'll turn it over to you.

MR. HARLOW: I got everybody, didn't I?

MR. HOFF: Thanks. Life is 90 percent just showing up, and that's sort of the way I feel today. I missed a flight out in the morning and haven't had a whole lot of time to prepare for this. So if it's a little rough, I apologize in advance.

For the Commander's sake, what we're here to do tonight and for members of the public is that we're gathered to, again, try and clean up two sites, and that's a good thing. We do a lot of investigating and a lot of time to hear about the investigations.

The focal point of all of these investigations there has to be cleanup, and that's what we're here tonight to discuss.

There are two sites we're going to discuss. One was a general disposal area that was used a long time ago. It's pretty much grown over since. The other site is even a little bit smaller than the former. It's an area of two pits that were dug to burn excess ordnance way back in, I believe, maybe the ’40s and maybe the ’50s.

Aerial photography sort of indicates it was certainly not operational past 1951 because you can still see the scars on the surface, but certainly there’s no activity. The grass and trees have began to clean the area.

So as far as this meeting goes, what we’d like to do is present to you what we believe, at least at this point in time, is a preferred alternative for these two sites. And that doesn’t mean we’ve selected a remedy. That’s where the public comes in. And what we’re asking for is certainly your acceptance on the matter.

And then also if you have any ideas during this 45-day public comment period, if you can get them to us in writing or either to Jeff verbally, we will take into account any input that you-all might have concerning these two sites such that we can get the acceptance that the Navy needs to go forward with the cleanup.

I will tell you this, these are two rather small sites. They are not highly contaminated, relatively speaking. When I say “relatively speaking,” I mean compared to Site 6, which we talked about the last time we had a public meeting. That site obviously is still under -- it’s ground under repairs, so to speak. The remediation is ongoing and we feel we’ve really got the tiger by the tail at that particular site. It’s certainly the worst we’ve had at the Station.

These two aren’t that bad, but sometimes the smaller sites and the least contaminated of the sites are the worst. Because you not only run the potential risk of human health, but also to the ecological receptor.

In a lot of cases where we look at receptors of the Weapons Station from a human standpoint, we know the condition of the Station is such that people are not where some of these sites are. They simply can’t be in -- these areas are restricted areas and it just certainly would not be safe to have people there and for the security standpoint of the Station’s ongoing mission. So a lot of times what we see is impacts on ecological receptors, and those are a little bit tougher to figure out sometimes.

I’m going to start by telling you what we believe the preferred alternatives should be. There are two sites which I spoke of, Site 11 which we’re calling Operable Unit 18 and Site 17 which is Operable

Unit 19. The operable unit term is one we use when we go to remediation, kind of as an accounting tool.

And as you can see, we're up to 19, I think, Weapons Station in terms of any of the activities that I'm aware of. It's certainly much further along than many other activities as far as getting the cleanup, so I think that's a very good thing. I think it's a tribute to Jeff and Kay, certainly to Scott of the Navy, and to you-all here because certainly your support makes that possible.

What we intend to do, there are two areas within those sites. There's an area at Site 17 we believe is a problem, and there's a small area at Site 11 which is identified when we talked to EPA about this remedy, oh, back a couple of months ago. And that area has an effect on ecological receptors.

What we propose to do is we propose to dig them up and dispose of them off site. Now, typically this Restoration Advisory Board doesn't like the idea of offset disposal. And I think that's a very noble goal. And we don't want to make your problems somebody else's, and we don't want to spread waste around if we can treat them on site.

There are two limitations to that. One is the types of contaminants that we have at both of these sites -- and I'll get into that a little bit more -- are not very amenable to any sort of on-site treatment. The ones that are the PAHs, you can look at land forming, that they are really at that level where people who do biological treatment don't want to touch the stuff because they are a high enough proposed risk, but unfortunately they are not high enough for microbes to break down.

So any kind of microbial technology that we might try to apply might not be very effective. So that's why we're, at least, presenting to you tonight the option of disposing the contaminated materials off site in a certified landfill.

Groundwater surface water and sediment for these sites we're holding off on. There's a couple of reasons for that as well.

One, the groundwater at Weapons Station is not used for (inaudible) purposes. And it all depends on what the aquifer you're in. And David Elms can certainly give you much greater detail on these aquifers than I. But we see their impact -- at least the contamination from our perspective is more of an impact on the surface water and sediment surrounding these sites; Indian Field Creek, Fell Gates Creek. The larger water bodies, we believe are probably the end receptors, certainly more so than any treating would be of contamination in groundwater.

So we propose to hold off on that until we get some input from the USGS, who is conducting a widespread groundwater model for us, and we will hopefully be integrating with USGS a little bit down the line to focus in on some of these areas and maybe provide us with some answers on groundwater and then its interactions, such as water and sediment.

COMMANDER RENFRO: Have you conducted a biological assessment?

MR. HOFF: We have conducted a couple of different types of biological assessments. The first –- and none of these are quantitative. They are primarily qualitative assessments where we do a walkover and identify the wetlands, if you will, from national (inaudible) maps, the topography. We have a soil study from the USGS that differentiates between certain types (inaudible) and those sometimes correlate to different types of environments that we see; hard woods, for example, versus open fields.

And for these particular sites, we think they are so small that we don't intend to do any additional ecological assessment.

This is something that we had a

particularly hard time with, is putting the perspective on where these are located. This is Weapons Station Yorktown obviously, this is the York River, this is Fell Gates Creek, and this is Indian Field Creek.

Sites 11 and 17 are located in this area. And this is an area where we have a couple of other sites that we've begun discussing. These two sites, 1 and 3, for example -- and it's one of the reasons that we are proposing holding off on groundwater, surface water, and sediment until we can do a larger assessment of the sites.

This is kind of a close-up, Site 6, the area where we are doing a lot of excavation right now to get the explosive contaminated material that you were seeing used in the treatment cell.

Site 7 is a site that has been formally remediated using the J.R. Simplot process. Sites 1 and 3 are proximal to 11 and 17. And it appears from the knowledge we have of the drainage that Indian Field Creek would be the water body we would most be concerned about with respect to these two sites.

Just a little background on Site 11. It's relatively small, point five acres. I didn't tell you at the outset that there were two pits that were excavated there for the purpose of burning any kind of excess explosives from loading operations.

Site 17 is a little bit larger. And, again, these are wastes that were reported to have been disposed there. It's hydraulic fluid and just general waste from public works and possibly some ordnance production waste as well. We'll get a little bit more in the investigation of both of these sites, but we did some test pitting and did not find any solid types of waste there.

This is an overview, a nice aerial photo, many that we have. And Site 17 is really limited to this area, within this small wooded zone.

Jeff, I don't know if there are any other features you want to point out?

MR. HARLOW: Not really. I guess, relatively speaking, Site 6 is -- point where Site 6 would be off the map, maybe for scale.

MR. HOFF: Site 6 --

MR. HARLOW: In the York River. The York River would be like north of that slide.

MR. HOFF: Site 11 is at the bottom. And this is kind of hard to see, but there's just a small area left here in the tree-lined region that indicates to us -- and the overlay is quite nicely with the historical photography. This is where the pits were at one point in time.

Back when we've -- when UPA identified these on the aerial photographs, none of these trees were even around. It was really amazing to see how wide open this was and how nicely the test pit dots stood out.

Just again, some more perspective. This is the Site 6 biocell. This would be the Site 11 area. And the Site 17 area would be right about there. I think this gives you kind of a good overall perspective of where we are.

This being the York River obviously and Fell Gates Creek.

Just another angle at it. Again, the biocell, Site 11 and Site 17.

This is a picture of the type of debris that we encountered at Site 17. And I want to note that this is all at the surface. When this was picked up, there was nothing discovered in the test pits. This is one of the reasons that the site was, in fact, included as a site when things got rolling back in the early '90s. There was a concern that there was some buried ordnance out there, and it just simply didn't come to fruition.

We did a number of samples at both sites. There was a round one conducted where we took a number of samples, and then there was a round two remedial conducted to fill data gaps. And I realize these are too small for you to read, but it gives you an idea of the coverage that we had of both the sites. And it’s always kind of tricky to show sample locations, especially discrete locations on a two-acre site because it looks awfully busy. But what does it mean?

I think in this perspective it shows we have covered the area as best we could from a random sampling scheme. And although the Site 11 sampling was random, the sample locations do coincide with the areas that we believe from aerial photography show former burning pits.

This is some information from round two. And as you can see, we confirm a lot of the sampling in round two that we did during the round one RI.

At Site 17, however, we did a number of test pits, and there are seven test pits in there. A test pit for us is really the best instrument we believe that we have at our disposal for investigating the subsurface. It allows us to turn the soil up and actually look at what’s there to four or five feet in depth.

Once we reach bottom and we haven't found anything, we collect samples. We are very careful to make sure the soil goes down in reverse order of how it was taken out, so if there is any damage, it's not spread about. But once the test pits are excavated, we're looking for that evidence of disposal, whether it be solid debris, some discoloration, product, what have you, and then we fill them back in.

COMMANDER RENFRO: Did you dig deeper (inaudible)?

MR. HOFF: Yes, we did. We did boring samples down to the water table. The water table is very shallow in this area.

COMMANDER RENFRO: Like at depth?

MR. HOFF: Nothing really at depth. We probably went down as deep four or five feet which is, again, right at the water table. We don't like to take a soil sample in the water table itself because there's always an argument about what it is you're actually evaluating; is it groundwater or is it soil? So we stop right above the water table. And it appears most of the contamination is at the surface and not at depth.

Just to give you an idea of some of the

chemicals of concern from a human health standpoint. Amino-DNT, it’s a degradation product of trichloroethylene in most cases. You have a step-wise reduction of the nitro group to the amino, and we see that a good bit out here.

The good thing about explosives, although we have had a lot of them, they are not recalcitrant by any stretch. They like to go away. That’s the nature of the beast. So in a lot of cases, we just don’t see the explosives that we otherwise thought we might.

We always come up with inorganics as being a problem; aluminum, arsenic, beryllium. These were mostly within the range of Station background. We conducted, back in ’93-’94, a pretty extensive background study of the Weapons Station. We focused on areas that we believed were unimpacted by any activity, and we also focused on those areas we felt were impacted by naturogenic means; logging roads, railroad tracks, and we’ve compiled that into a database and we compare statistically.

In most cases, we don’t get into a whole lot of statistical interpretation. When it comes down to remediating, we’re really looking for the maximum protective background because it’s not wise, in our opinion, to really undergo wholesale remediation for something that may fall within the range of background.

Site 11 there was really no -- at depth there was no organic contamination. Arsenic was a problem. Arsenic and iron turned up. The surface soil, I'd also like to mention that from a human health standpoint -- we'll be rolling on -- but there is going to be a little bit of a different profile of contamination than what you'll see ––

COMMANDER RENFRO: Does arsenic or chromium degrade anything over time?

MR. HOFF: No, sir.

COMMANDER RENFRO: Or combined?

MR. HOFF: Now, if chromium was present in, say, a state of plus six, it's possible that it could be oxidized to a chromium plus-three over time. But I think you'd have to have some sort of process that would put the plus-six there in the first place. We don't get into speciation too much. But, no, it won't be too great.

Site 17, human health COPCs. This is where we turned up the PAHs. These were in a few areas that we identified as a hot spot. We call it a soil area of concern and feasibility study. And it's fairly well delineated. We went out with test kits to make sure that we had some idea of the extent before we actually identified it as a hot spot in the EFS.

And, again, nothing much in shallow subsurface. A little bit of PAH. Shallow subsurface is a sample taken from zero to one foot. We believe the EPA requires a zero to six-inch sample as a shallow where it’s a surface soil sample. So we call these a shallow subsurface. And it allows us to use the data from the round one RI.

You notice the list grows when you start talking about ecological chemicals of concern. And part of that is that there are just so many members of the environment to consider when you conduct this sort of a risk assessment.

We did find a little bit of Bis(2-ethylhexyl)phthalate. If I could explain, Bis(2-ethylhexyl)phthalate is a binder in plastics. It exists primarily as a polymer. Our extraction process will put it out as a monomer.

In most cases it’s either a laboratory artifact, maybe somebody with plastic or latex gloves on touched something they shouldn’t have or it could have been us when we were in the field. It is possible we got a piece of plastic in there or used something that contacted the soil that had plastic in it and, lo and behold, you come up with Bis(2-ethylhexyl)phthalate.

MR. RAFKIND: This is a term -- we actually picked -- just the mere fact that you use tick-off spray it gets picked up in samples.

MR. HOFF: We’ve found a lot of those. If you ever found limeni or some of the other oils in TICs, you can tell when someone who was sweating pretty good, they handle a sample --

MR. RAFKIND: Yeah.

MR. HOFF: But the list goes on. We have TNT. And certainly the inorganics are much more of a problem for us from an ecological standpoint.

Surface soil in 17, pretty much the same, PAH, Bis(2-ethylhexyl)phthalate. And then the list of the inorganics.

Of particular concern for us with the inorganics is copper and mercury. These were at Site 11. We also had some problems with mercury, with zinc, and a little bit of copper, too. I think it may not have made the list here, but there were some pits of copper that posed ecological risks.

Those compared to background were slightly elevated. They didn’t drive the human health risk, but they do give us problems in the ecology. So the question is, what do you do with this data? And how do you interpret that from the standpoint of remediation?

From our perspective, we try to take a look at the short-term effects you'll have on the ecology with any type of an evasive scheme. In most cases when you're talking organics, there isn't a lot of things you can do in situ. There have been some sort of removal and vitrification process. And to do that, you'll have to tear up an awful lot of the habitat that we're supposed to be trying to protect.

Just a recap. Human health risk, Site 11, is below 1x10^{4}. Now, that health risk, if you will, is a generally acceptable number below which EPA doesn't usually bother doing a whole lot with. I say generally, because it doesn't apply in all cases.

And what that says is for the contaminants we have there that were identified as carcinogens, if a person was exposed -- and in this case, it was a future resident child and adult -- 350 days a year for their entire life, they would have an excess cancer risk for Site 11 of less than one in 10,000.

And, again, ecological, we have the

copper and mercury and zinc popping up as being problematic and something we couldn’t explain away for the background.

Site 17 -- again, the PAHs here drove us from a risk perspective. PAHs, if anybody has ever barbecued out, you get a lot of PAHs in a hamburger. The problem with PAHs is that from a fuel standpoint, from an exposure standpoint, you don’t want to get any more of these than you necessarily should. That doesn’t mean you shouldn’t barbecue because they are sort of ubiquitous really and it’s the product of an incomplete combustion process of anything that would be organic. Nevertheless, under our scenarios we do pose a risk to future residents exposed to the PAHs and soil.

And we do have this area identified pretty well. And I think we had a maximum concentration of about 42 milligrams per kilogram. We are going to propose an action level or clean-up level of about 9.6 milligrams per kilogram to protect human health. So we’re about –- between four and five, higher than that, and we believe that will warrant some action.

Hazard indices or other systemic problems, it was below one, so we didn’t have a real problem there.

From an ecological perspective, again copper, mercury, and zinc showed up. The highest coincided with our PAH hot spot, which was 17SS10. We’ve delineated it with test kits and we have a real good handle on the extent of PAH contamination.

And in this case we’re lucky the PAHs that we intend to remediate coincide with the inorganics that are posing an ecological risk for us. So 17 is a pretty easy case.

COMMANDER RENFRO: (inaudible) significant reduction in the immediate sample sites right around that one or --

MR. HOFF: There was a reduction, and remediation will be to provide further reduction. One of the things that was not in vogue with the EPA or any regulatory body years ago was reaveraging risk once you had decided to take action in a hot spot. I think from a residual risk perspective, that’s getting more and more merit.

In the FS we have to identify the remedial action alternatives. And the remedial action alternatives always include a no-action alternative. One of the reasons we do that is because in any good policy analysis, you have to consider doing nothing as a baseline. So we did. It certainly is not something we're going to maintain because we find it is not protective of human health or the environment at either site.

The second alternative isn't much different than the first. It would simply entail monitoring to see if any of these contaminant concentrations would be polluted at the time by whatever process, whether that was dilution or some sort of biological breakdown. We know that that wouldn't be the case for the (inaudible), but we would still evaluate that. That's not going to be a choice for us.

A soil cover was our third remedial alternative that we evaluated for both areas. It would entail certainly the clearing and grubbing that would be associated with a removal action. The problem with the soil cover is Jeff and Kaye and certainly resources from the Station have to be brought to bear to maintain it in order for it to be effective, and it's not the Station's mission to act as a landfill.

So it certainly is an alternative we'd like to consider. And in some cases, it might be a viable alternative, but we don't want to have a whole lot of landfills all over the Station that somebody has to maintain ad nauseam.

RAA 4 is excavation and on-site treatment. I touched a little bit on this. That alternative fell away for us because it doesn't address the more advanced contamination, and it really doesn't do anything to address the low levels of the PAHs that we were looking at. We've had Bob Ferguson in here before; he's done the Daramend process, and we talked to him about what level he would like to see because he can remediate PAHs using his method. And he said he wouldn't touch anything below a hundred EPA. So even if we wanted to go with Bob as an option, I think he would be a little reluctant to take this one on.

And finally five is the excavation and off-site disposal.

This gives you a rundown of some of the evaluative criteria we apply. RAA 5 is protecting of human health. It certainly is going to be protective of the environment in the long term, but it's not without its short-term concerns. Again, you don't want to kill something to save it.

And technically what we have is a situation where with mercury and copper, there are exceedences, but if we were to alleviate every exceedence, it would result in, really, a wholesale elimination of the habitat as it exists now. And we also have the erosion concerns at the Station -- and certainly Chuck could attest to the erosion concerns of this area. And so we don’t feel it’s warranted to go after every exceedence, only a few select hot spots.

We say that there’s not reduced mobility, toxicity, or volume of the examination of treatment because treatment is one of the things that certainty EPA and people want to see and certainly something RAB wants to see. Because if you treat it, you don’t make the problem somebody else’s.

In this case we really don’t feel that it’s viable to treat this type of waste. And the cost is about $300,000 for this alternative.

This is just a little bit of why RAA 5 is better than some of the other alternatives we evaluated. It is permanent. It’s readily implementable and it’s more cost effective. The only ones that wouldn’t be more cost effective would be the ones where we do nothing.

This is an idea of the two hot spots we intend to remediate. This is the PAH hot spot at Site

17. And this is a very small -- it's about 45 cubic yards of soil of copper and mercury contaminated soil at Site 11.

The good thing about this is there is an ingress, a means of ingress. We're not going to have to take a whole lot of trees out to do this. And because it's an open area, we'll be able to salvage a good bit of the mature trees in the area. We're not going to have to wholesale, clear, and grub.

Site 17, on the other hand, is going to entail the removal of trees. You're going to see some real dirt being moved with that particular site.

I just wanted to let you know that the public comment period began May 16th. We announced i last Sunday in the paper and it closes on June 30th. So there's plenty of time to evaluate this.

And, Bob, I'm going to let you know they say it's final, and that's the purpose of opening the public comment period. And we welcome comments and certainly you, members of the concerned public. And if you have any comments, get to Jeff and Kay by whatever means necessary and we'll do our best to address it.

COMMANDER RENFRO: Where does the soil go?

MR. HOFF: The soil will go to a landfill. That landfill will be determined by a couple of different things. When you excavate the soil, you'll test it for toxicity, corrosivity, ignitability, and reactivity. In essence, if it tests as hazardous, it will have to go to a hazardous waste landfill.

We don't believe that this will test as hazardous, although we've certainly been wrong on that before. If the test is nonhazardous, it will go to another type of landfill that is appropriate and can take it.

COMMANDER RENFRO: Is it a one-time cost or something that's stretched out over the years? You're talking about the 300,000 estimate?

MR. HOFF: That should be a one-time cost. There's no monitoring associated with this. Once this is removed and the areas are regraded and revegetated, there should be no other actions.

We do have a five-year review period and the EPA will be evaluating the efficacy of this action. They evaluate it to determine whether or not there's any new technologies out there to do a better job. They evaluate it from a toxicity standpoint to see whether or not concentrations that are left behind pose a greater risk when and if the toxicological data becomes available. But it should be a one-shot $300,000 deal.

COMMANDER RENFRO: Vegetation goes with the dirt, trees?

MR. HOFF: Yes, sir. I think in a lot of cases we’ve been trying to use native grasses to reestablish the areas. It really depends on which area we’re speaking of. I know we’ve done trees in the past.

MR. HARLOW: I mean, as of to date, we hadn’t really, unless we’ve had some certain sites -- like Site 6, which I’ll talk about in a few minutes -- if it was in direct contact with the contamination, it would go with the waste, if it’s associated somewhere in the sideline.

Some of the stuff -- I mean, some of the clearing and grubbing we do, we say around the areas for access or whatever and we turn that over to the firewood program and different things, try to reuse as much as we can to minimize landfill.

MR. MOSS: Barry, do you guys look at on-site disposal? I mean, you’re talking about what’s the -- how bad a deal is it to do an on-site?

MR. HOFF: Well, an on-site disposal

would be something like putting a cover down. And I think if we did that, you would be into that loop of maintaining whatever it is you did than if you were consolidating this material in a landfill.

And I think we have kicked that idea around. At Site 22 where we have the biocell. If we can co-dispose wastes that had similar types of contaminants, would that be something that would be acceptable to the state, the EPA. From a regulatory standpoint, I don't know if that passes mustard.

I think from the Station's standpoint, they don't want to get into a situation where they have to actively manage a landfill, particularly if it's hazardous waste.

MR. MOSS: Once the stuff goes to the landfill, there's no Station cost in -- you know, to monitor it from then on? I mean, it would be somebody else's problem; is that what it is?

MR. HOFF: Well, yes and no. If it's a hazardous waste, then certainly the Station manifests it out, they always maintain responsibility for it. Such that if they were to manifest a hazardous waste that goes to landfill and later on that landfill runs into trouble, its liner leaks or some other violation, then the Station would have a great responsibility for the hazardous waste.

As a nonhazardous waste, I really don't see it as being much of a problem because it will be combined with a number of other wastes that the landfill would be taking in and it would probably be used as a cover more than anything else.

MR. HARLOW: Rich, did you talk about volumes or anything? The volumes were pretty low.

MR. HOFF: The volumes are fairly low. I want to say that it's about 1,300 cubic yards for the Site 17 work. That's a fairly large amount of soil. 45, 49 cubic yards, I believe, for the Site 11; copper and mercury contaminated soil. So probably talking something less than two thousand cubic yards overall.

COMMANDER RENFRO: How does that equate to dump cost?

MR. HOFF: I was just trying to think about that. How many cubic yards --

MR. HARLOW: Ten to fifteen for a dump truck.

MR. HOFF: I was going to say 10 in a dump.

MR. HARLOW: You get four-axle trucks, they are going to be 15 and 16 yards, I think.

MR. HOFF: Yeah.

That’s pretty much all I have. Any other questions?

Thanks everybody.

(Hearing adjourned at 7:17 p.m.)

COURT REPORTER'S CERTIFICATE

I, SCOTT D. GREGG, RPR, and Notary Public, certify that I recorded verbatim by Stenotype the proceedings in the captioned cause, in Lackey, Virginia, on May 20, 1999.

I further certify that to the best of my knowledge and belief, the foregoing transcript constitutes a true and correct transcript of the said proceedings.

Given under my hand this 27th day of May, 1999, at Norfolk, Virginia.

Scott D. Gregg

Scott D. Gregg